APPLIED HYDRAULICS

APR 4 952

THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS

ROCKET COSTS REDUCED BY HOT AND COLD FORMING 35

OXIDATION OF PETROLEUM BASE OILS 41

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CONSTRUCTION HINTS FOR HYDRAULIC EQUIPMENT 48

HOW TO REDUCE CAPITAL TOOL COSTS 52

NEW COMPONENTS . . . . 59 USEFUL LITERATURE 74

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Aeroquip Detachable, Reusable Fittings reduce hose line inventory. For on-the-spot replacements cut bulk hose to required length and attach fittings.

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New Dual-Purpose Vane-Type Unit for 2000 psi Continuous Duty

2½ to 70 gpm deliveries as a pump, or torque ratings of 12 to 257 inch-pounds per 100 psi, as a motor

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Write for Bulletin P-5. The Denison Engineering Co., 1166 Dublin Road, Columbus 16, Ohio.

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Only 3 Major Components

OUTBOARD PORT HOUSING

PUMPING CARTRIDGE

INBOARD PORT HOUSING

DENISON Hydr OILics

PUMP/MOTOR

"The Finest Money Can Buy!"

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APRIL 1952
Vol. 5, No. 4

APPLIED HYDRAULICS

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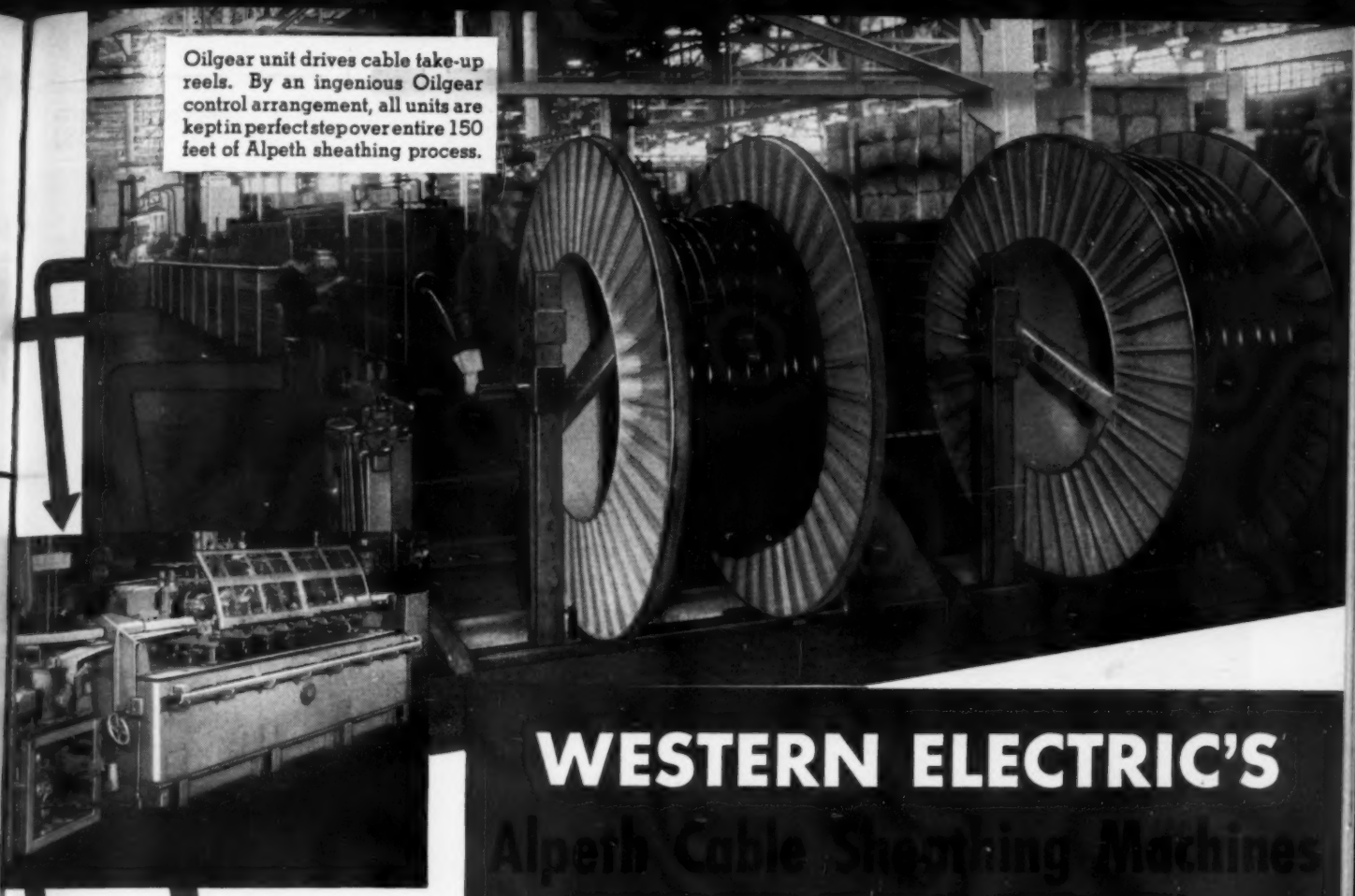
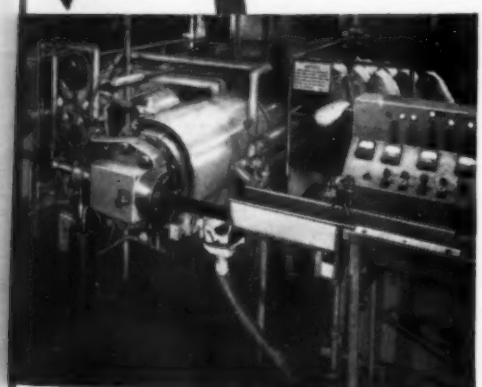


Oilgear unit drives cable take-up reels. By an ingenious Oilgear control arrangement, all units are kept in perfect step over entire 150 feet of Alpeth sheathing process.

Oilgear fluid p[illegible]r drives Yoder roll forming machine which [illegible]aps corrugated aluminum sheathing arou[illegible]able.



Oilgear drives[illegible] synchronized to speed of Royle [illegible]uder which covers cable with melt[illegible]olyethylene.

Tractor capstan powered by Oilgear, which pulls cable through extruder, long cooling trough and inspection station.

WESTERN ELECTRIC'S Alpeth Cable Sheathing Machines use OILGEAR FLUID POWER drives

• Right after the war, the Bell System faced a tremendous problem because of the shortage of lead for sheathing telephone cable. To solve that problem, a newly designed sheath known as Alpeth—aluminum polyethylene—was adopted. And the engineers had to design a machine fast that would apply this sheath fast—to produce this new cable by the millions of feet.

Oilgear engineers, working with *standard* Oilgear Fluid Power pumps, motors and valves, met the need for drives that would handle the complex Alpeth coating machines, dependably, without trouble . . . and for drives that could be immediately, easily and economically installed . . . requiring minimum space, sure performers from the start.

The first Alpeth cable sheathing machines installed by the Western Electric Company proved themselves and more units were installed, to make a total of three at the Kearny, N. J., Works and three at Hawthorne Works in Chicago. The Oilgear drives have performed well, without trouble, with minimum maintenance, often at high speed for 24 hours a day.

A company like Western Electric does not buy by guesswork. Neither should you. THE OILGEAR COMPANY, 1564 W. Pierce Street, Milwaukee 4, Wisconsin.

Oilgear

PIONEERS IN FLUID POWER

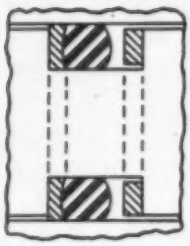
PUMPS, MOTORS, GEARS, [illegible] CYLINDERS

OILGEAR

Circle 47 on Reader Service Card

TEFLON PACKINGS

for Hydraulic & Pneumatic Cylinders, Presses, Pumps, Valves



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For protecting O-rings and other packing from extrusion, deterioration and loss of efficiency—select Chemiseal Back-up Rings, made of Teflon—a natural for hydraulic service.

These rings are chemically inert, can't be affected by oils or solvents. They won't harden, soften, swell or shrink in service. Tough, resilient, they support the packing with which they are used, greatly lengthen its life. Try them, and you will standardize on them.

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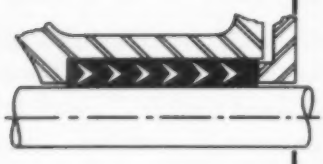
The ideal valve packing that seals with low gland pressures and operating torque, made from solid Teflon or Teflon compounds. Extremely resilient, tough and anti-hesive—it cannot seize the valve stem or shaft—is long wearing, impervious to all hydraulic fluids, outlasts other packings several times over. Supplied in sets with square-end Teflon adaptors. Send for catalog No. 810 V.



*du Pont's trademark for its tetrafluoroethylene resin

UNITED STATES GASKET COMPANY

FLUOROCARBON PRODUCTS DIVISION

FABRICATORS OF "TEFLON", "KEL-F" AND OTHER FLUOROCARBON PLASTICS

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Circle 73 on Reader Service Card

LETTERS to the Editor

We are quite anxious to obtain the name of a manufacturer or supplier who makes a hydraulic drive which we could apply to an installation we are contemplating. This would consist of a main pump driving a series of turbines at, say, thirty or forty foot intervals. These turbines would be driving the various belts of a conveyor, consisting of several belts in series; the main object being that when the main pump was either speeded up or slowed down, or the hydraulic flow was controlled to achieve the same result, all the turbines would then follow this controlled change simultaneously.

D. C. WARD
Project Engineer
Engineering Division
The Goodyear Tire & Rubber Co.
New Toronto, Ontario

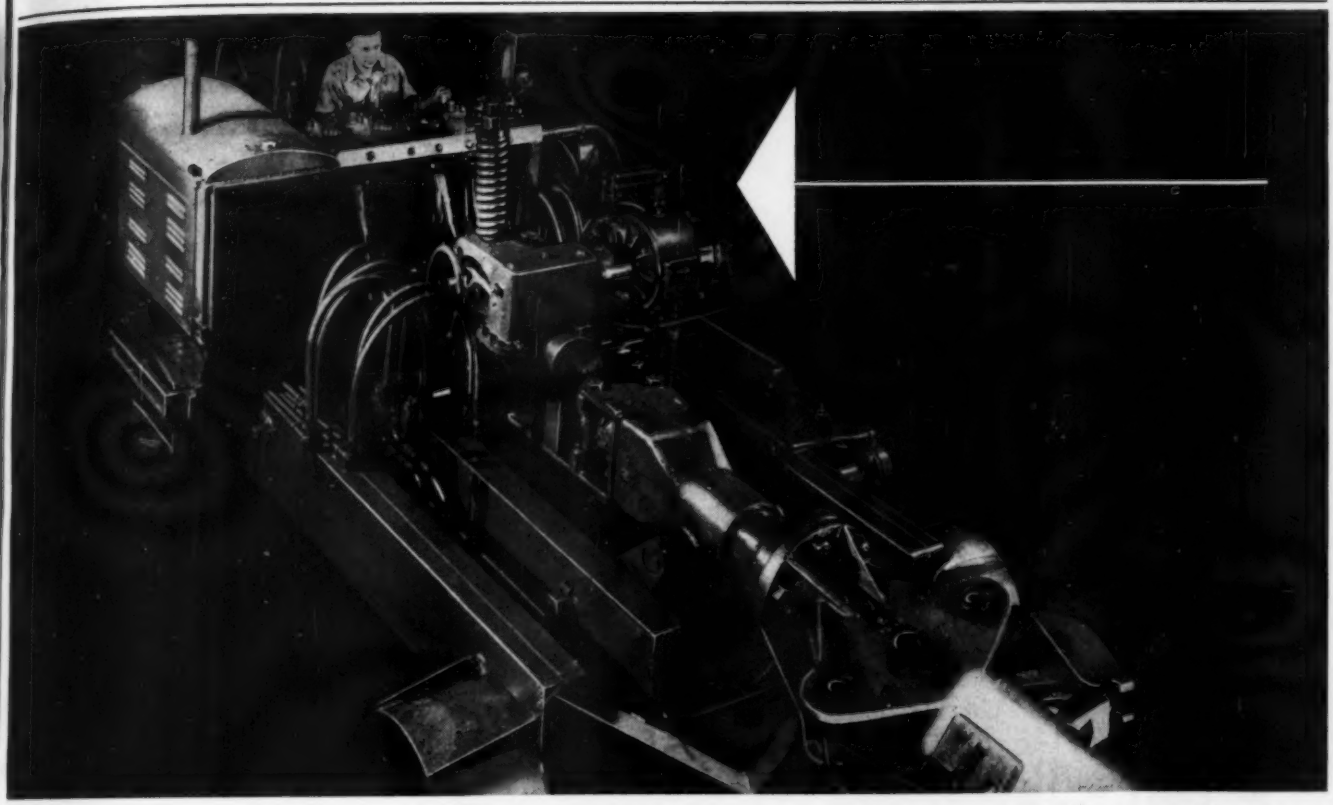
We suggest you consult with a specialist close at hand. We believe that Mr. John C. Spotton of the John Spotton Company, 4237 Dundas Street W., Toronto 18, Ontario would be able to be helpful.

As an independent representative I receive requests from engineers to detail and qualify a hydraulic circuit system so that it can apply to their basic mechanical engineering. I am particularly interested in more or less simplified hydraulic circuits that can be easily explained to the average layman.

C. G. FORSHEY
Engineering-Sales-Surveys
Houston, Texas

Basic hydraulic circuits do not vary very much for many types of industrial machines. However, there are refinements which may be peculiar to a given machine or drive, speed of operation or accuracy of cycle control. The problem of applying a hydraulic circuit to a specific problem is a matter of experience and field training. We regularly publish hydraulic circuit diagrams, in most cases to JIC Standards. A number of our readers write and

WHEN IT'S HIGH PRESSURE IT'S AMERICAN!



Every operation of this modern mammoth is actuated by a

HELE-SHAW PUMP

BROSIUS AUTO-FLOOR MANIPULATORS serve hammers, hydraulic presses and heating furnaces in forging plants . . . and every working motion of these powerful machines is hydraulically actuated by a Hele-Shaw Pump. Brosius Division, Salem-Brosius, Inc., Pittsburgh, bought its first Hele-Shaw from American Engineering back in 1929, and it has been the standard specification ever since.

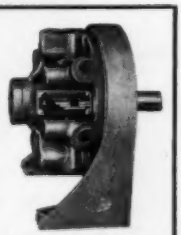
Hele-Shaw is a radial-piston variable displacement fluid power generator for oil pressures up to 3000 p.s.i. It can be readily applied to the machine it serves . . . installed on or near the machine, remote from it or included as an integral part of the design. Discharge is infinitely variable from zero to maximum. Capacities range from 0.5 to 66 g.p.m.

Your American Engineering Company representative is thoroughly qualified to analyze any of your hydraulic needs, engineer and install the required power units, and assume responsibility *locally* for dependable, uninterrupted service. In addition, he is able to promise unusually good delivery under today's conditions.

Mail coupon for facts leading to new power efficiency.

HYDRAMITE
for pressures up to 5000 p.s.i.

The AE Hydramite is a unique radial piston constant displacement fluid power generator with an overall efficiency of 85% without supercharging. It is available in 3, 5, and 10 g.p.m. oil capacities. Can be foot, flange or face mounted.



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AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Le-Hed Hoists, Le-Hed Car Pullers.

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2530 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Kindly send me complete information about the
☐ Hele-Shaw Pump. ☐ Hydramite.

Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....

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FOR ALL
Hydraulic and air Controls
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EFFICIENCY AT LOWER COST WITH
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There's a free bulletin full of reasons and proof.
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DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 15, PA.

DARCOVA
THE ORIGINAL COMPOSITION CUP
PUMCUPS

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tell us that they clip and preserve circuits on the types of work that they run into most frequently in their day-by-day work. The series of articles by Rupert P. Esser on circuit hints that we have been running are, for example, taken from the working sales kit which Mr. Esser carries at all times.

May I have a copy of the National Conference on Industrial Hydraulics paper "Growth and Application of the Accumulator" by Edward M. Greer, as mentioned in your December issue of APPLIED HYDRAULICS?

JOSEPH F. HUFF
Design Engineer
Control Engineering Corporation

The National Conference on Hydraulics publishes all the papers delivered each year in an annual "Proceedings". The secretary, NCIH, Technology Center, Chicago 16, Ill. can advise you when the 1951 Proceedings will be available. We will also announce the date in APPLIED HYDRAULICS. It is possible that Mr. Greer, who is president, Greer Hydraulics, Inc., 456 Eighteenth St., Brooklyn 15, N. Y. may be able to furnish you with a copy.
*See page 94

We would appreciate it very much if you would send us a complete 1951 index to APPLIED HYDRAULICS.

LOIS M. YIKE, LIBRARIAN,
Aeronautical Division
Minneapolis-Honeywell Regulator Company

The 1952 Directory issue (January) of APPLIED HYDRAULICS contains both a subject and author index for 1951.

With reference to your article "Hydraulic Cylinders" in the December 1951 issue, please advise the name and address of the manufacturer of the telescopic cylinder described on page 57.

EUGENE B. HOLMES
Chief Engineer
Atlas-Boxmakers, Inc.

The manufacturer of the telescopic cylinder in question is The Commercial Shearing and Stamping Co., Youngstown 1, Ohio. Among other manufacturers of telescopic cylinders are Ledeen Manufacturing Co., 1610 San Pedro St., Los Angeles 15,

INDUSTRIAL PRODUCTS DIVISION

WESTINGHOUSE

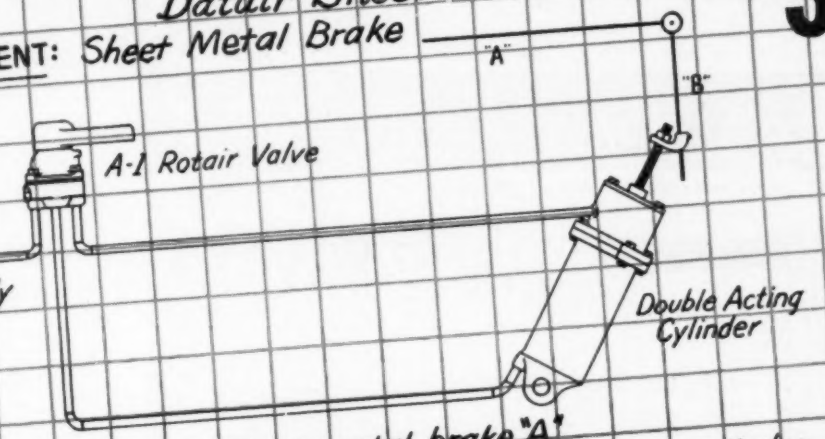
AIR BRAKE COMPANY
WILMERDING, PENNA.

Ideas for Engineers

#3

Datair Sheet

EQUIPMENT: Sheet Metal Brake



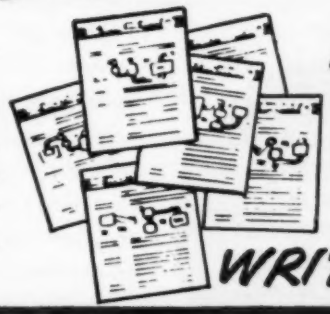
APPLICATION: Operate Sheet metal brake "A" A-1 Rotair valve controls double acting cylinder which operates brake leaf "B". "Lap" feature permits the lifting of leaf "B" and stopping of operating cycle to check alignment before completing bending operation.

SOLUTION: Westinghouse A-1 Rotair Valve and Westinghouse Double Acting Cylinder installed.

RESULT: Manual foot operation of brake eliminated. Operator provided with complete control of device through complete cycle of operation. Production increased. Accuracy of work improved.

And, again AIR Solves the Control Problem!

Here's another example of a Control Problem—quickly and practically solved through the use of W A B Pneumatic devices. Thousands more can be solved just as quickly through different applications and combinations of W A B equipment. Our Engineering Data File will provide you with some practical cases. Sections of it may apply to your problems.



FREE

THIS ENGINEERING DATA FILE

WRITE

INDUSTRIAL PRODUCTS DIVISION

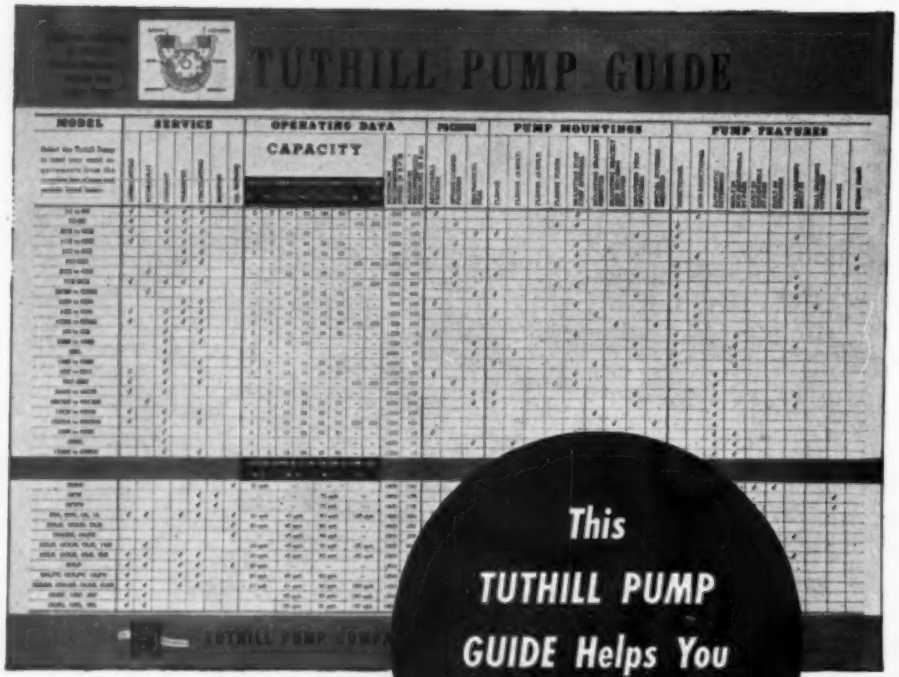
WESTINGHOUSE

AIR BRAKE COMPANY
WILMERDING, PENNA.

Factory Branch: EMERYVILLE, CALIF. Distributors throughout the United States . . . Consult your Classified Directory. Distributed in Canada by: Canadian Westinghouse Co., Ltd., Hamilton, Ontario.

Circle 80 on Reader Service Card

NEW EASY WAY TO SELECT THE RIGHT PUMP FOR THE JOB



This TUTHILL PUMP GUIDE Helps You Find the Answer

To save you time and trouble in selecting the pump best-suited to your application, Tuthill engineers have developed this revolutionary new Pump Guide. Here, in one easy-to-use chart, is a volume-full of information on the complete line of Tuthill Pumps.

At a glance, it shows you the services for which each model is built, together with performance characteristics, types of packing, mounting styles and distinctive features that enable you to fit the pump to your need, rather than the need to the pump.

Copies of this helpful guide are now available on request. Write for yours today—there's no obligation.

Tuthill Positive Displacement Pumps serve Industry in Lubrication, Hydraulic, Coolant, Oil Burning, Circulating and Transfer Service.

TUTHILL 25th Anniversary

TUTHILL PUMP COMPANY

939 East 95th Street . . . Chicago 19, Illinois

Circle 71 on Reader Service Card

Calif.; Logansport Machine Co., Inc., 832 Center Ave., Logansport, Ind.; Galland-Henning Mfg. Co. 2753 S. 31st St., Milwaukee 46, Wis.; and Hydraulic Equipment Company, 1104 East 222nd St., Cleveland 17, Ohio.

Your recent offer in your January issue, to supply a 1952 Data List would be put to good use in our Process Section. Since we get many requests for information regarding hydraulic equipment from our Hydraulic Supervisors, I would appreciate receiving your magazine for its helpful aids.

C. A. CROSS,
Process Section
Manufacturing Engineering Dept.,
Engine and Foundry Division
Ford Motor Company

A copy of the 1952 Data List has been forwarded to you. We are also putting your name on the list to receive copies of APPLIED HYDRAULICS.

We note in our February issue of APPLIED HYDRAULICS that you are to publish a 1952 distributor's list. We should like to know how we can be listed in this directory.

ROBERT N. WILLARD
The Willard Engineering Co.

We are sorry to tell you that the 1952 Distributor's List has been closed and is now on the press. This list, which is primarily for the use of our advertsers, contains the names and addresses of all dealer and distributor organizations whose principal business is the engineering and sale of hydraulic and pneumatic components and systems, primarily as independent representatives of manufacturers. We will, however, put your name on our supplementary list, which will be distributed in the same manner as the major list.

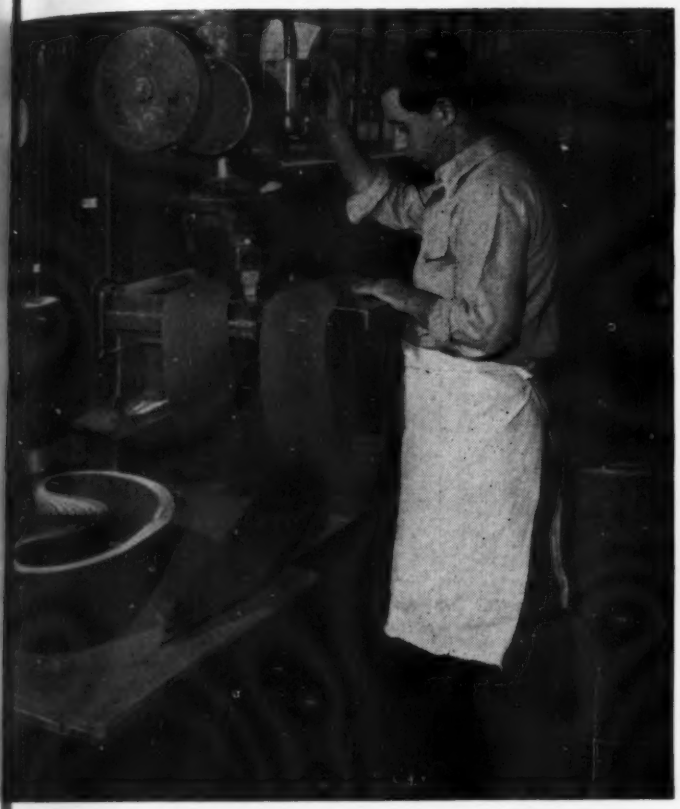
We would appreciate your sending us two copies of the article "Predicting Rotary Air Motor Performance" by E. T. Kisselburg and W. F. McCombs, which was in the February, 1952 issue.

J. L. DOOLEY
Engineer Manager
Rhodes Lewis Co.

We are sending you two sets of tear sheets of the article "Predicting Rotary Air Motor Performance" as requested.

Circle 65 on Reader Service Card

SERIOUS PRODUCTION LOSS STOPPED BY SWITCH TO SUNVIS H.D. 700 OILS



VARNISH NO OBSTACLE—This is one of the many presses of various sizes which form joints in abrasive sanding belts for production use in the automobile, jet engine and woodworking industries, as well as many others. Six years ago equipment like this press needed costly maintenance at frequent intervals because of varnish formation. Then a Sunvis H.D. 700 Oil was adopted as the hydraulic medium, and the trouble disappeared like magic.

NO OIL CHANGE—This large press is used for joining abrasive belts used in polishing stainless steel. Although the oil temperature at which it operates is 130 F, the 200-gallon charge of Sunvis H.D. 700 is still in excellent condition after nearly four years' use.

Among the 30,000 types of abrasive specialties made by Behr-Manning Corporation, Troy, N.Y., Division of Norton Company, are sanding belts requiring smooth, uniform joints. Dozens of hydraulic presses, ranging in capacity from 5 to 150 tons, form the joints to the same thickness as the belts.

The hydraulic oil in use six years ago created a production obstacle by forming varnish in the pumps and valves. At least once a year the systems had to be overhauled and the pumps sent to the manufacturer for repairs, with consequent production loss.

Behr-Manning then changed to Sunvis H.D. 700 Oils, as suggested by a Sun representative. Because of the detergent-dispersive characteristics and high stability of these oils over a wide range of speeds, loads and temperatures, varnish formation was immediately cleared up. Since that time, no overhauls traceable to oil have been necessary. Annual savings in pump repairs have been substantial and no oil changes have yet been required.

For complete information about "Job Proved" Sunvis H.D. 700 Oils, fill out the coupon below.

SUN OIL COMPANY, Dept. AH-4
Philadelphia 3, Pa.

I am having trouble that may be caused by an inadequate hydraulic oil.

☐ Please send me booklet "Sunvis H.D. 700 Oils."

☐ Please have a Sun representative contact me.

Name_____

Title_____

Company_____

Street_____

City_____ Zone____ State_____

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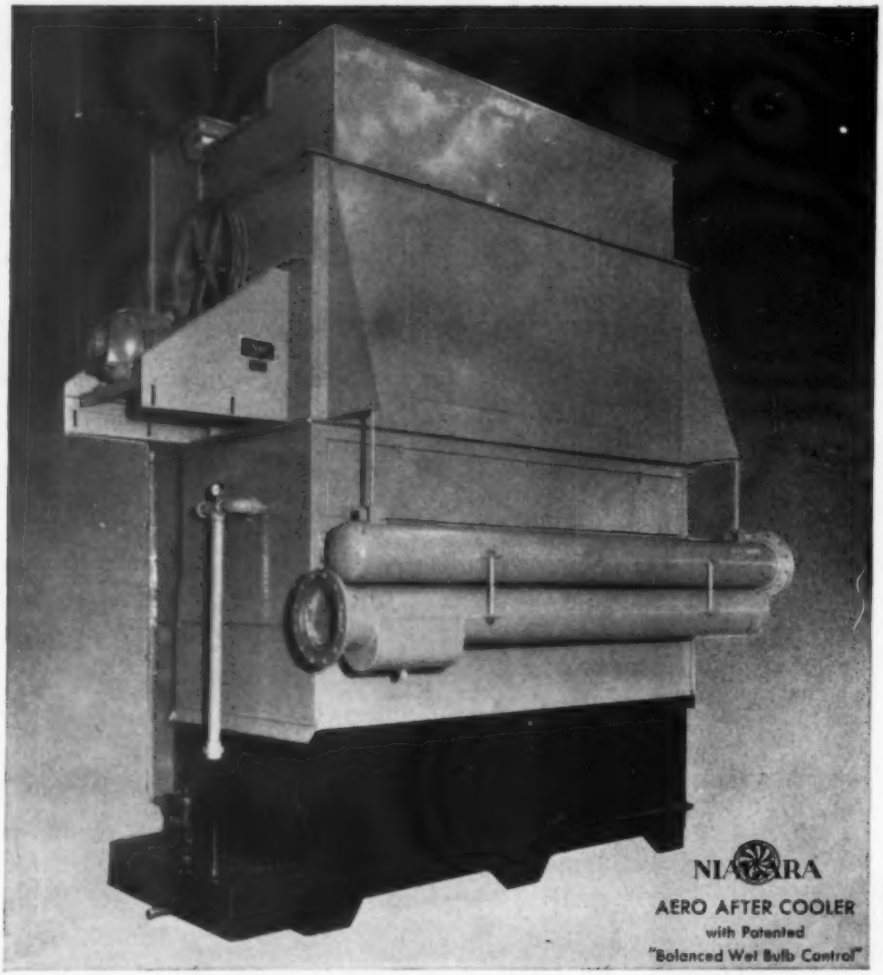


How to PREVENT CONDENSATION in COMPRESSED AIR LINES

● Users of pneumatic tools and machinery spend thousands of dollars on repairs and suffer much interruption to production from the condensation of water in their air lines. In compressed gas systems and in processes where compressed air is blown directly on parts and materials in production, there is additional damage.

You can prevent these losses by installing a Niagara Aero After Cooler. It cools the compressed air or gas by evaporative cooling and removes the water before the air enters the receiver. This method brings the air to within a few degrees of the wet bulb temperature, making certain that your compressed air will always be colder than the atmosphere surrounding the lines in your plant, so that no further condensation can take place.

Savings in cooling water pay for the installation. Experience shows that the patented Niagara evaporative cooling method consumes less than 5% of the water required for cooling by conventional means. You save the cost of the water, the cost of pumping it, the cost of disposing of it. These extra savings soon pay for the Niagara Aero After Cooler.

Write for Bulletin No. 98

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. AH 405 Lexington Ave., New York 17, N. Y.

Experienced District Engineers in Principal Cities of United States and Canada

INDUSTRIAL COOLING HEATING • DRYING
NIAGARA
HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Circle 44 on Reader Service Card

LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

POSITIVE IN ACTION are the valve actuators which are detailed in Bulletin 512 published by the Ledeen Manufacturing Co. Also available are literature on cylinders (Bulletin 500) and valves (Bulletin 510).

Circle 34 on Reader Service Card

NEW CARTRIDGE TYPE packing gland on hydraulic and air cylinders is shown in engineering data available from Petch Manufacturing Company.

Circle 52 on Reader Service Card

SOLUTION to lubrication problems may be found in Blueprint No. 113 which has been published by C. A. Norgren Company.

Circle 43 on Reader Service Card

SAVING TIME and increased efficiency are the important factors of the quick connecting couplings described in literature available from The Hansen Manufacturing Company.

Circle 27 on Reader Service Card

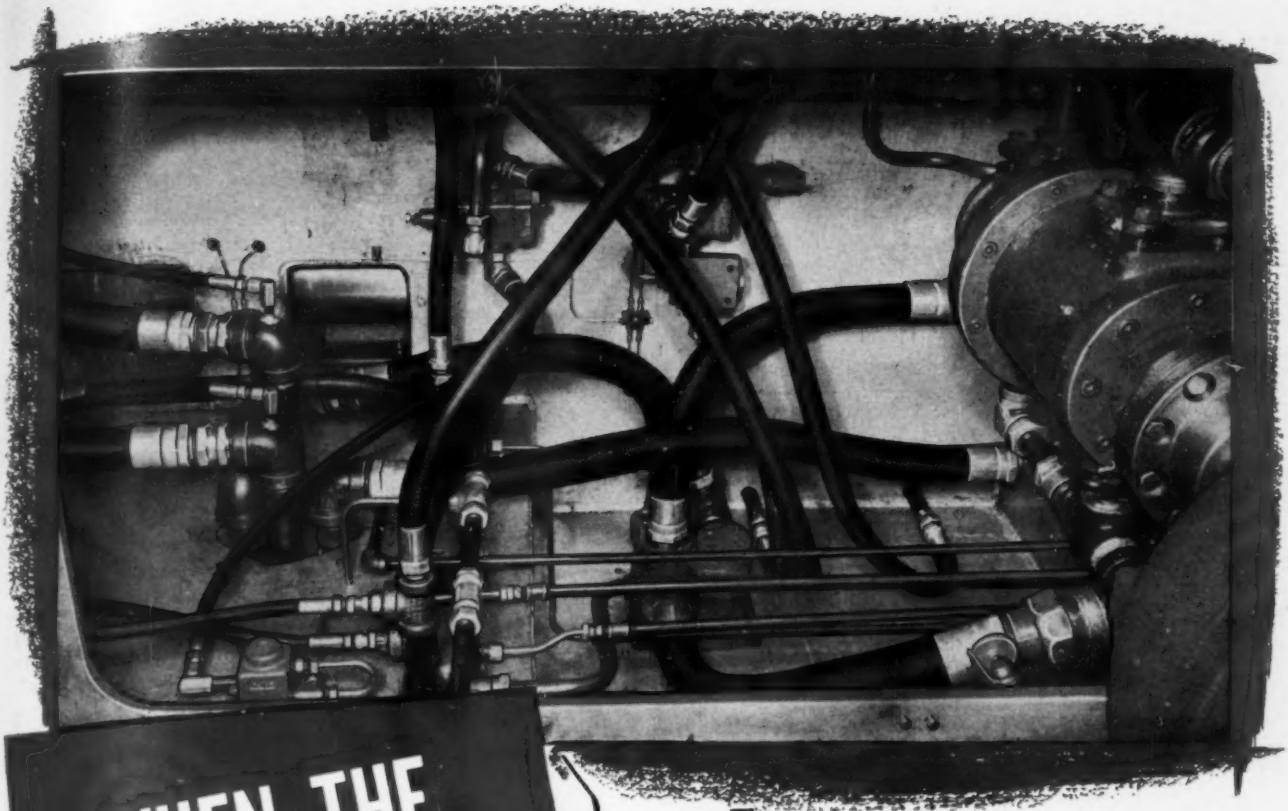
ENGINEERING DATA FILE available from Westinghouse Air Brake Company provides practical cases of control problems which can be solved through use of WAB pneumatic devices.

Circle 80 on Reader Service Card

NEW CUSHION DESIGN for air cylinders, which insure positive cushion action combined with automatic valving action for fast return stroke and also eliminates binding and sticking, is described in Bulletin 252 published by Tomkins-Johnson Co.

Circle 69 on Reader Service Card

Continued on page 16



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D-12

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Fluid Power Lines

Hydraulics and Defense

One of the largest hydraulic installations that we have ever seen is in the Cadillac Tank Plant in Cleveland. It's the multi-head Wean Grinder which you'll find described in this issue. The pictures give you some idea of its tremendous size. Because it could only practically be assembled in the line, no one saw the finished machine until the whole job was completed. This meant a lot of careful layout work and planning. Valve panels which carry both the air and oil components greatly simplified the construction and the servicing of this giant machine.

Another defense production problem which has been solved by the use of oil powered equipment is the forming of rocket bodies. Many of the bodies have complex shapes which are difficult to produce without resorting to fabrication. By combining the Rockrite cold forming process with the Westin hot forming process tubes can be upset to conform with the required rocket contours. Several of these "hard to produce" shapes are pictured in this month's lead article. The hydraulic circuit used on the Westin process is analyzed.

Dollars for Tools

Any good engineer can offer several alternatives for tooling up a job. Each may have its merits and limitations, and the decision between them will be based primarily on cost. The flexibility of oil or air powered tooling often provides a production setup which will meet the required schedules with the lowest initial tooling cost.

How the Pollak Steel Company solved a tooling project with a capital tool cost of only $15,000 as compared to the five figure costs which alternative plans would have cost is described in the article "How to Reduce Capital Tooling Costs".

We talked with Alvin Alt and Jack Binns at Planet Products Corporation who designed and built the equipment for Pollak. They have an aggressive, enterprising outfit intelligently applying hydraulic circuits. Since many of their machines are specials, they make a practice of photographing the tubing and piping. This saves the time and cost of formal drawings and gives them a permanent record from which the same or similar circuits can be piped.

Ford Production Line

Production schedules and tooling costs were again important factors in the redesign of the Ford Chassis riveting line. Large expensive presses were replaced by more flexible individually oil powered rivet guns. The cost of the new installation just about equalled the cost of the dies which were required for the old press setup.

Joseph Maseth, a Ford application engineer and Jack Bennett of Garrett Burgess, Inc. describe the hydraulic booster system used on this new line and present some of the planning which went into the development of this new circuit.

Oxidation of Oil

Everyone using a hydraulic system is concerned about his oil costs and about any maintenance costs which are the result of oil breakdown. When a system runs hot it's a sure danger sign that pumps and valves are taking undue abuse, that feeds have become inaccurate and that the oil life is going to be reduced. In the December APPLIED HYDRAULICS, Don Morrell described methods of regulating temperature in hydraulic systems. This month J. Theodore Wolff, design engineer with the Axelson Manufacturing Company has written a special report on the oxidation of hydraulic oil.

W. T. McCormick, tool designer, has been with the Caterpillar Tractor Company for nearly 15 years most of which has been spent in hydraulic design and machine building. In this issue he starts a series of articles on "Good Practices in Designing and Building Hydraulic Power Systems." His observations digest years of experience at the tool bench, machine assembly and rebuilding, circuit analysis and trouble shooting. We believe his approach—the analysis by a conscientious craftsman of methods found practical and successful—will be of value to many production, design and maintenance men.

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Continued from page 12

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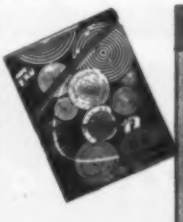

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OUTSTANDING FEATURES, such as maximum operating efficiency, easy installation, reduced maintenance and service on piping, of high pressure hose assemblies are outlined on catalog sheets, available from the Anchor Coupling Company, Inc.

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VALVES FOR ALL TYPES of operations are illustrated in Catalog 1250 issued by the W. H. Nicholson Company.

Circle 45 on Reader Service Card

POWER SUFFICIENT to operate components even when pumps fail, is one of the features of bladder type accumulators illustrated in Greer Bulletin 301.

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ENGINEERING DATA and catalog on "O" Rings are available from the Plastic and Rubber Products Company.

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EFFICIENCY LOSSES CAN BE PREVENTED by using an Aero After Cooler. Cools compressed air or gas by evaporative cooling. Niagara Blower Company offers Bulletin 98 describing all its features.

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TO HELP you with your piping layouts, Roylyn, Inc. offers an illustrated catalog which details their complete line of fittings.

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HYDRAULIC VALVE which automatically regrinds its own surfaces is described in Bulletin H 210 issued by the Yarnall-Waring Company. The bulletin also contains types and sizes.

Circle 82 on Reader Service Card

FREE RETURN FLOW is permitted by an adjustable flow regulator. An illustrated circular describing their design has been prepared by the Waterman Engineering Company.

Circle 78 on Reader Service Card

Continued on page 18

Meet Henry F. Eagan

Technical Director

International Packings Corporation

Affiliated with Graton & Knight Company

Study of materials and their components has been Mr. Eagan's life work, and he can be credited with many of the rapid advances in the use of synthetic rubbers. After graduating from Clark University with a B.S. and M.S. degree in Chemistry, he was an analytical chemist for 9 years. At Graton & Knight for 11 years, first as Chief Rubber Chemist, now as Technical Director of International Packings Corporation, it has always been his job to select the proper materials for a given packings application—and to supervise quality control in every stage of production. Member of the Rubber Division of The American Chemical Society and Society of Automotive Engineers.

In this series of advertisements we want you to meet the people who make G&K-INTERNATIONAL Packings.

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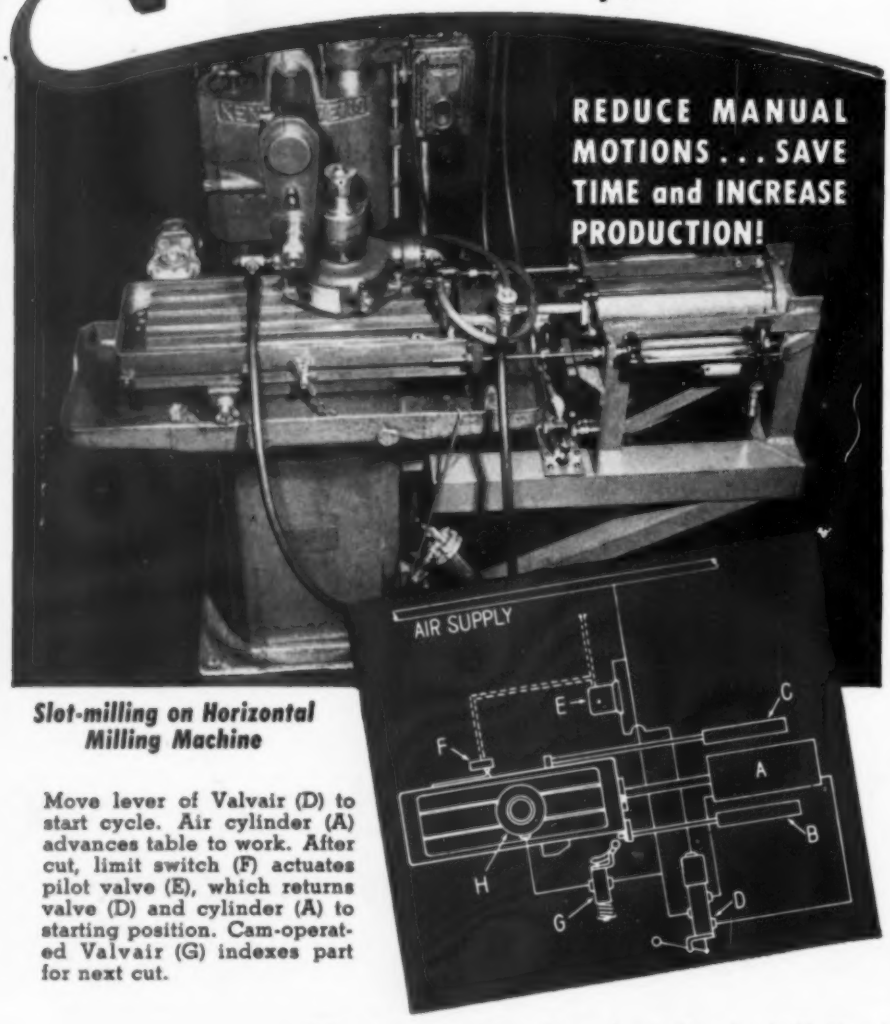

Slot-milling on Horizontal Milling Machine

Move lever of Valvair (D) to start cycle. Air cylinder (A) advances table to work. After cut, limit switch (F) actuates pilot valve (E), which returns valve (D) and cylinder (A) to starting position. Cam-operated Valvair (G) indexes part for next cut.

All air control valves and the installation are by Valvair. Valvair's basic body design fits nine control assemblies. Internal parts are also interchangeable. Valvair *Diversatility* puts real flexibility into your plant operation. Let Valvair engineers or your local Valvair representative help solve your problems involving pneumatic circuits.

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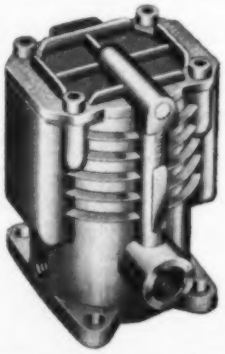
Valvair's new solenoid pilot valve is used in the above installation. Available in 2-way and 3-way models, normally open or normally closed. Valve ordinarily operates over 20,000,000 cycles with no maintenance.



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HYDRAULIC PUMPS using twin matching gears are illustrated in Catalog H 4 available from the Commercial Shearing & Stamping Company.

Circle 10 on Reader Service Card

HIGH QUALITY construction of air cylinders is described in Bulletin A 105 issued by the Miller Motor Company. Complete dimensional and application data is included.

Circle 42 on Reader Service Card

FOR VOLUME PRODUCTION, valves and fittings to specifications are described in a catalog, available from the Kohler Company.

Circle 33 on Reader Service Card

LONG WEARING Chemiseal V. type packing made of Teflon are illustrated in Catalog No. 810 V issued by the U.S. Gasket Company.

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YOUR SEALING NEEDS may be solved by special types and styles of packings which are detailed in Bulletin DMAH issued by Durametallic Corporation.

Circle 17 on Reader Service Card

MANY SUPERIOR ENGINEERING FEATURES of positive remote control are described in a catalog issued by Superdraulic Corporation.

Circle 64 on Reader Service Card

HYDRAULIC CONNECTIONS are described in catalogs No. E-1457A and No. H-1457A available from the Weatherhead Company.

Circle 79 on Reader Service Card

EQUIPMENT BULLETIN detailing a new unit for automatic water removal and oil filtration, is available from the Honan Crane Corporation.

Circle 30 on Reader Service Card

NOPAK VALVES AND CYLINDERS are featured in Bulletin SW-1 available from the Galland-Henning Mfg. Co.

Circle 20 on Reader Service Card

PUMPCUPS for all hydraulic and air controls are described in a Bulletin available from the Darling Valve Co.

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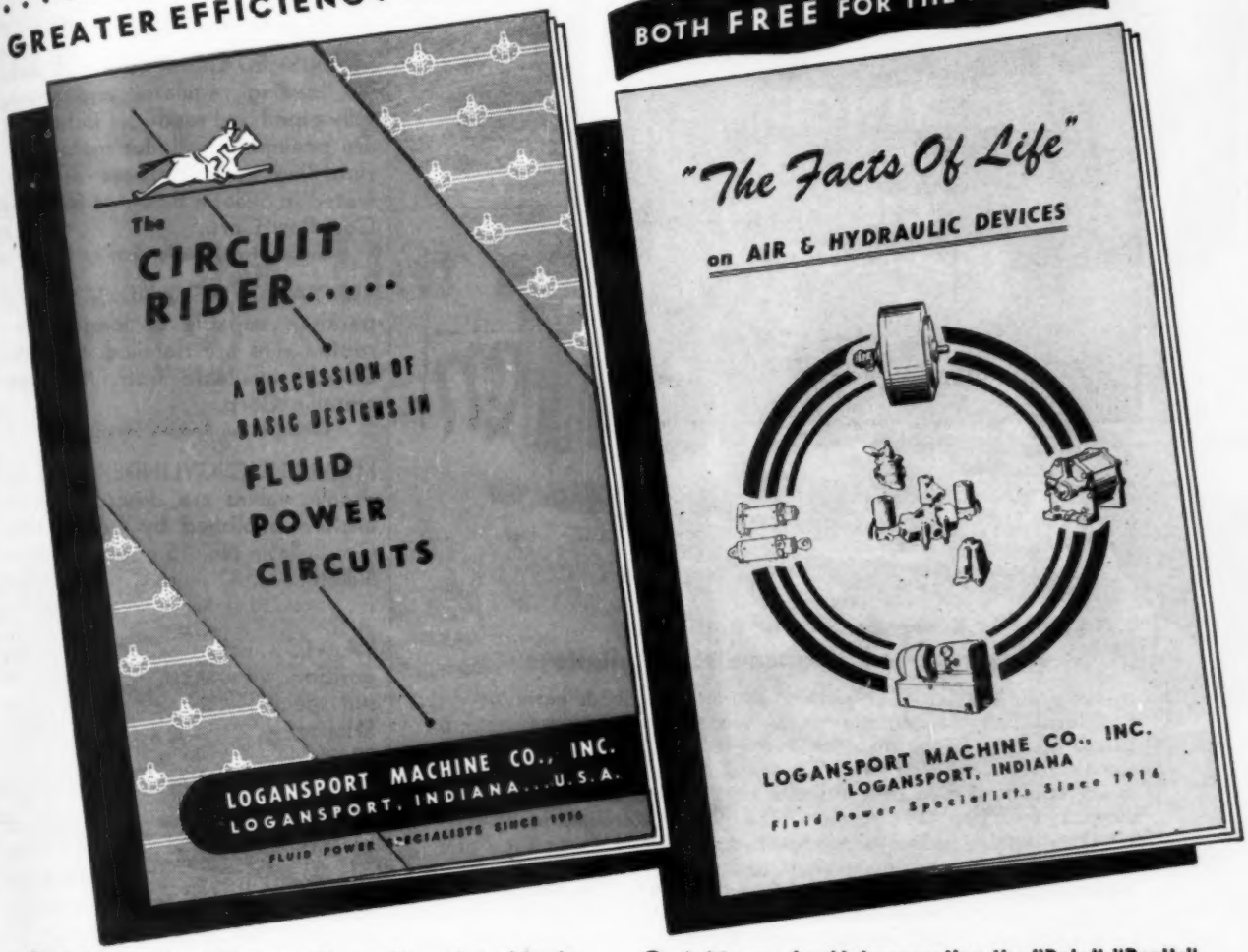

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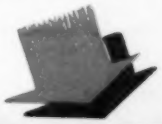

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Continued from page 18

DIAGRAMS and specifications of parts for cylinders are given in a Bulletin prepared by the Ortman Miller Machine Co. Also available are drawing templates for cylinders which will simplify and speed your machine layout.

Circle 48 on Reader Service Card

FURNISHED COMPLETE with cushion loading regulator and gauge, fully piped and ready for installation are pneumatic cylinder motors with throttling control. These are illustrated in Bulletin B-50-AH issued by Conoflow Corp.

Circle 11 on Reader Service Card

SPECIAL TYPES AND STYLES of packings capable of long uninterrupted runs are detailed in Bulletin DMAH available from the Durametallic Corp.

Circle 17 on Reader Service Card

HYDRAULIC CYLINDERS and hydraulic valves are described in literature published by Pathon Mfg. Co. Bulletin No. 15 covering valves, Bulletin No. 17 illustrating cylinders.

Circle 50 on Reader Service Card

VALVES which may be used in any position with pipe connections to suit specifications are described by Skinner Electric Valve Div. in Bulletin 501.

Circle 60 on Reader Service Card

CONVERTIBLE, for either pump or motor applications, is the new Denison dual purpose vane type pump. This unique dual purpose hydraulic pump is described in Bulletin P-5 published by The Denison Engineering Co.

Circle 15 on Reader Service Card

SAFEGUARDS AGAINST LOSS OF PRODUCTION TIME by use of an air warden, is described in literature available from the Hannifin Corp.

Circle 84 on Reader Service Card

VARIDRIVE MOTORS which will increase your output are illustrated in a Bulletin showing various types of Varidrive motors from 2-10,000rpm. This Bulletin has been issued by the U.S. Electrical Motors, Inc.

Circle 72 on Reader Service Card

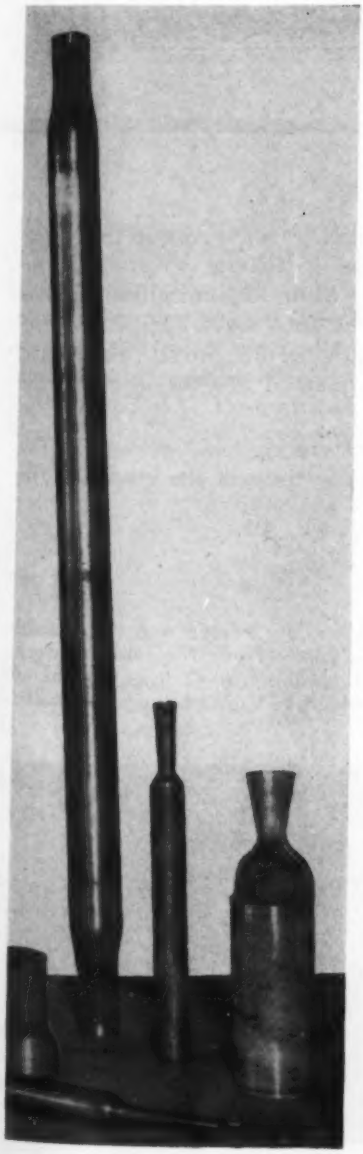
PERFORMANCE CHARTS and specifications of the unloading gear type hydraulic pump are available from the Pesco Products Division.

Circle 51 on Reader Service Card

A SOLENOID PILOT VALVE whose basic body design fits nine control assemblies, is described in Bulletin P issued by Valvair Corp.

Circle 75 on Reader Service Card

Rocket Costs Reduced by Hot and Cold Forming



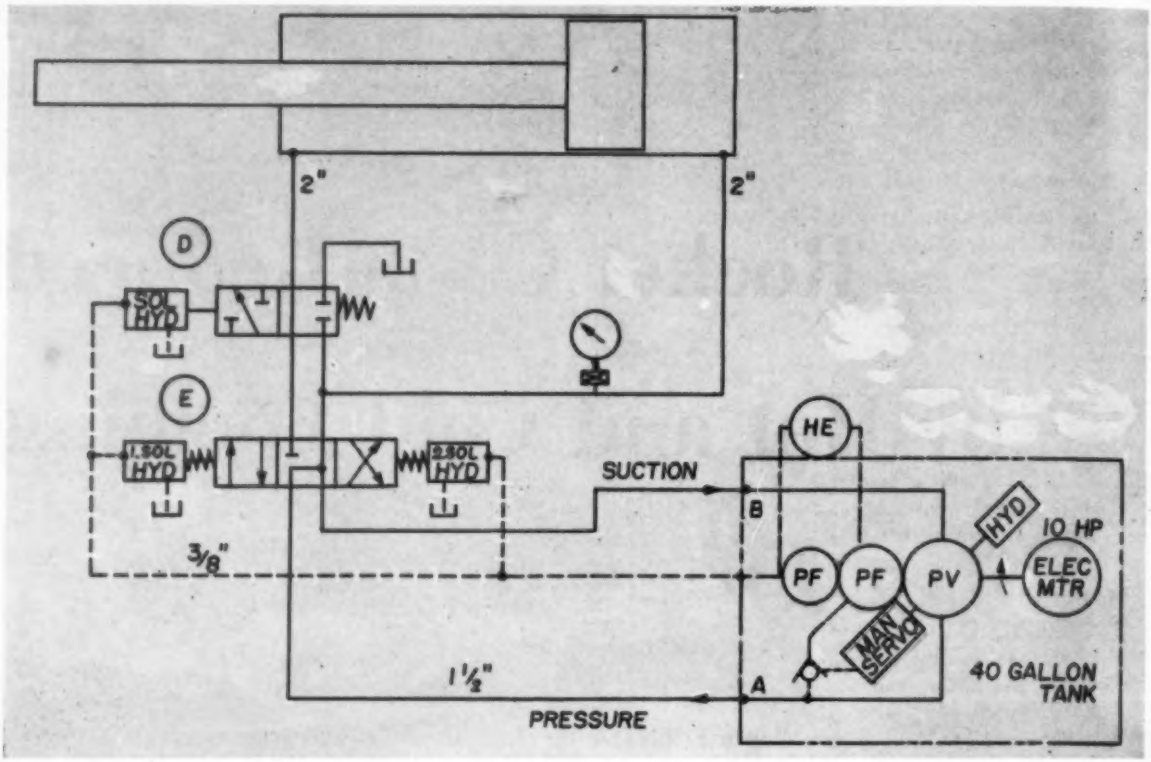
COMPLEX ROCKET bodies are precision sized and then hot formed. Fabricating and joining operations are eliminated to produce a sounder finished part at less cost.

RECENTLY the Tube Reducing Corporation, which introduced the cold reducing or compression forming process some years ago, added two Westin Process hot forming machines for production work. The combination of cold compression forming and hot forming of tubing, have given this company the first known complete production facilities for both compression forming of precision tubing and upsetting operation for the economical and rapid hot forming of many shapes.

In the Westin Process, the rotating tube is heated by passing electric current of low voltage and high amperage through the metal walls. The tube, when sufficiently heated to a predetermined temperature, then enters the dies which impart to it the desired shape.

Surface finish of the completed product is smooth and free from scale, as contrasted to other hot forming methods. Another advantage of the resistance heating is that the temperature can be accurately controlled, avoiding work hardening and formation of strain flaws. Size and concentricity can be held close, especially where accurate compression formed tubing is used for the starting piece.

This method hot-forms the ends of the tubing into parts such as braces and struts for aircraft landing and flap control gear, rocket



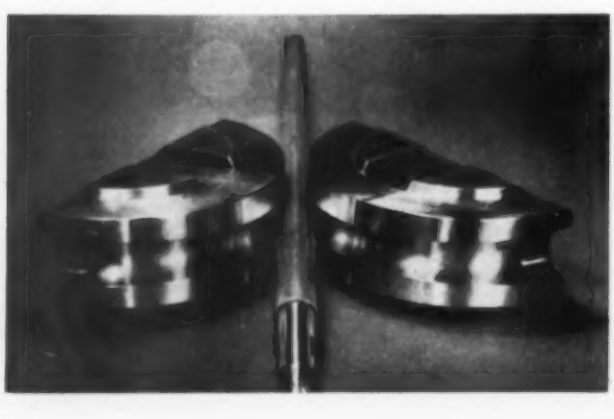
and jato bodies with convergent-divergent nozzles, compressed gas bottles, completely closed tubes, conveyor rolls and other shapes requiring a reduced section with a heavier wall.

Cold Compression Forming

In the "rockrite" process, perfected by Tube Reducing Corporation, semi-circular, taper-grooved dies are rocked back and forth over the tube compressing the metal against a mandrel which controls the inside diameter. In the rocking movement the gradually diminishing cross section of the tapered grooves results in a compression of the tube walls against a corresponding tapered mandrel. In this, the OD, the ID and the wall thickness are reduced and the length of the tube is increased.

A specially designed reducing machine is used. The tube is fed longitudinally through the machine. The

COLD FORM THE BODY—The tube, on a mandrel, is squeezed between rocking dies. The tapered grooves of the dies cause metal to flow both longitudinally and circumferentially. The process differs from cold drawing, where a tube is drawn through a die over a mandrel.



HOT FORM THE END—The formed end is removed from the die. Hydraulic power feeds the rotating work which has been heated by passing electric current of low voltage and high amperage through the metal walls.

Differential Circuit Speeds Hot Forming and Upsetting of Tube Ends

In addition to using a variable volume pump which can be positioned to deliver high volume, low pressure oil, an exceptionally high rapid traverse forward is obtained on the Westin Process Machine by providing differential advance.

The differential advance circuit can be cut in and out by actuating solenoid of valve D. Using both this differential advance and a variable volume pump provides a circuit which can give the following forward traverse speeds and forces:

1. With solenoid 2 of valve E and the solenoid of valve D energized, the 7⅛ in dia., 84 in. stroke cylinder will traverse at 465 ipm with 300 psi oil exerting a 5800 pound force in the pushing direction.

2. If valve D is deenergized, the differential feature is eliminated and forward speed drops to 230 ipm with an increased pushing force of 11,900 pounds at 300 psi oil pressure.

When the tube has been rapidly traversed up to the dies, the pump control lever is shifted to reduce oil delivery. A maximum full tonnage speed of 55 ipm at 2500 psi exerting a force of approximately 50 tons is available.

At the end of the forming stroke, limit switches actuate the solenoids of valves E and D to reverse cylinder travel. The pump control lever is returned to the position of maximum delivery and the cylinder rapidly reverses at a maximum speed of 457 ipm with 6000 pounds force. If the force required to strip the work from the die should be greater than 6000 pounds the pump will automatically shift to provide a maximum stripping force of 50,000 pounds at a speed of 108 ipm.

The servo type control used on the pump responds readily to provide the required oil delivery and pressure for each part of the cycle.

tube is given a partial turn on its axis so the roll-compression working is distributed over the entire circumference of the tube. Both longitudinal and axial movements of the tube during reduction are timed to operate alternately after the forward and return strokes of the saddle containing the dies.

By the combined use of both compression forming equipment and the Westin Process machines, tubing can be compression formed and then upset in dies after electric resistance heating. The resistance heating and forming takes place simultaneously in the Westin machines. In addition to the advantages of the compression forming, both processes mean a reduction in transportation costs by eliminating handling between two or more processing points; plant operators can detect and report rejects immediately.

Are You Wasting Air?

Walk through your machine shop after working hours and you'll most likely hear the hissing sound of escaping air. It is air lost because a blow off valve has not been completely closed. It's an expensive hiss.

Air under 100 psi pressure escaping through a ¼ inch bore amounts to approximately 100 cfm. Your compressor is taking about 25 horsepower from the power lines or from the driving engine. It's wasted power. At a low 2 cents per kilowatt hour, if you are buying your electricity that cheaply, the hissing noise costs you about 35 cents an hour.

Here's what you lose in useful work: If one of your machine fixtures uses a 3 inch bore cylinder with a working stroke of 3 inches you could operate the cylinder 8000 times on the air which is lost in one minute from that ¼ inch hole that's hissing at you.

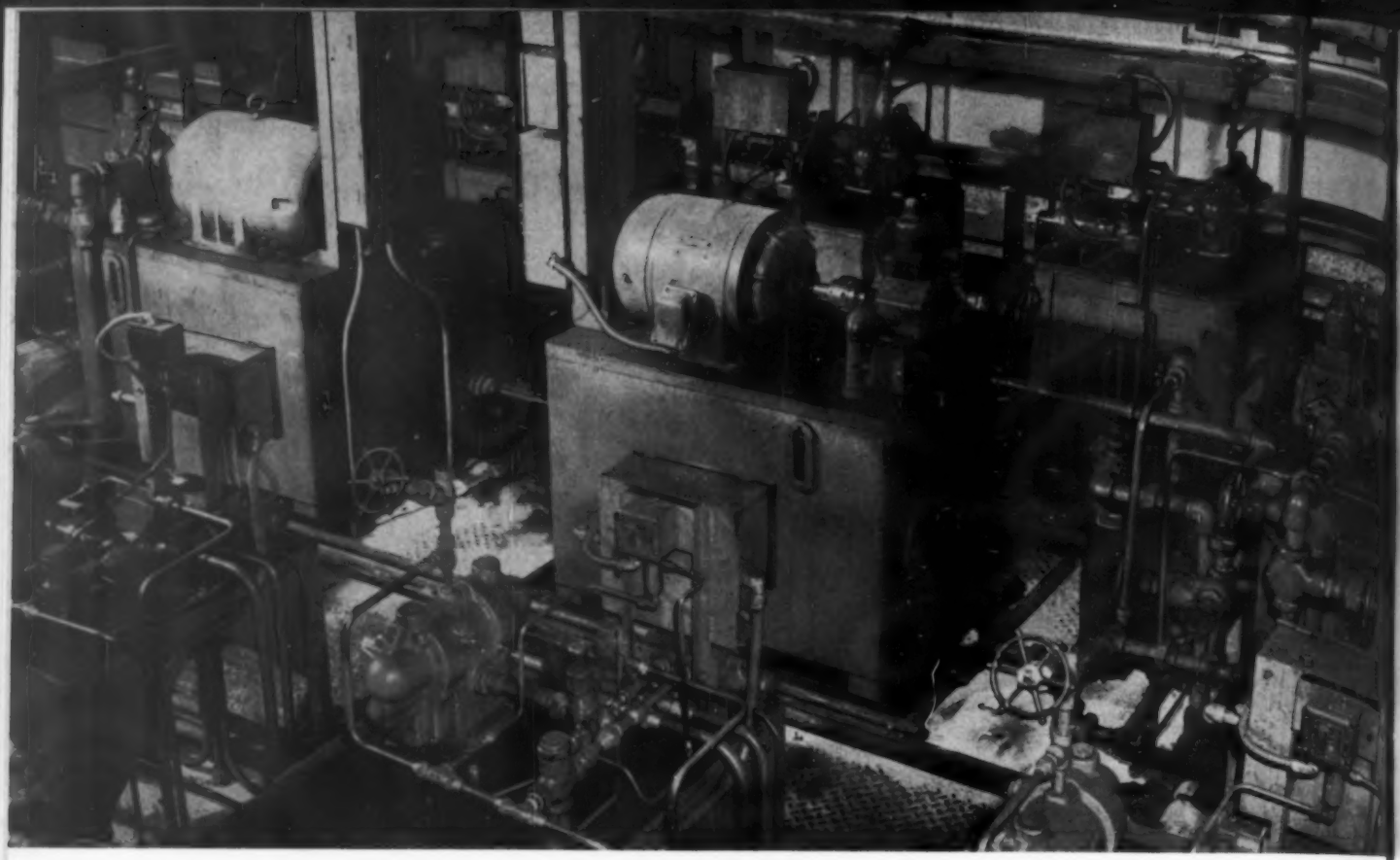


FIG. 1. ALL THE HYDRAULIC units are on a balcony above the rivet lines. Between the two rows of table mounted booster stations are the pump and motor units. Each of the two lines of 5 working booster units is supplied by one pump unit. There is a spare pump unit for each line and a sixth spare booster unit in each line.

How Ford Replaced Large Presses With Oil Powered Tools

By Joseph Maseth and J. H. Bennett

RIVETING operations on automobile frame members are now being done with maneuverable hand guns powered by readily controlled oil booster circuits. Oil pressure generated at 600 psi by a pressure compensated variable volume pump is stepped up to 3000 psi by the booster to give a 15 ton riveting force at the gun.

Figure 2 shows a riveting line in action at the Ford River Rouge Plant. Frame members move along on a conveyor and are positioned on simply constructed locating fixtures. All the hydraulic power units are located on a balcony above the line. Figure 1 shows a general view of equipment on the balcony. Four frame lines are powered by the equipment. There is a booster station for each gun, five in each of the two lines plus one spare for each line. Two pump and tank units are used; one for each of the lines. Two spare pump units are on the balcony ready to be cut in, by turning a valve, in the event of shut down of either working pump. Arrangement of equipment on the balcony provides easy accessibility to units for maintenance and has reduced considerably the down-time of this installation.

Continuity of production is of course a must on automotive lines. It is extremely costly to have any section in a line down for any length of time. With this in mind, the riveting line was designed to assure continuous operation. The spare units can be put into action in a very few minutes and production continued while the impaired unit is serviced.

Die Cost For Press Is High

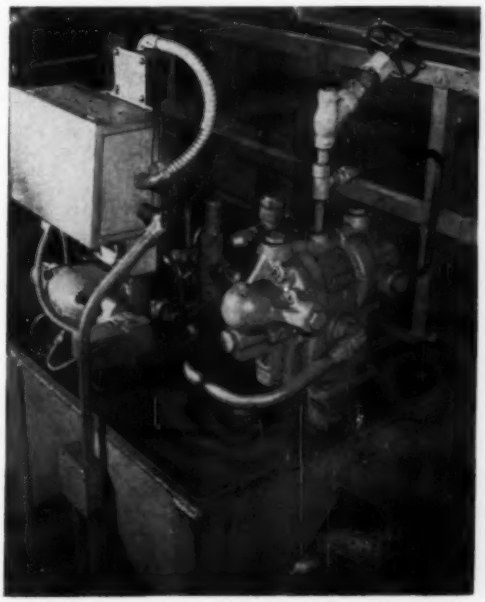
Establishing this new line involved an entirely new approach to the choice of riveting methods. These individually powered hydraulic riveting guns replaced four large 315 ton mechanical presses. At first glance, it might seem that such a change is completely unorthodox for a mass production operation. Here were large presses completing a part at every stroke being replaced by individual riveting guns. *Would such a change in tooling result in at least equivalent output? What about cost of new equipment? Would labor costs be comparable?*

Use of large presses had some serious drawbacks. First, large costly capital equipment was being tied up. Second, die cost was substantial. Standby dies of course had to be maintained in case of breakdown. Changing dies was not a very fast or convenient task

Joseph Maseth, application engineer, Design & Standards Dept., Ford Motor Co., Dearborn, Mich.
J. H. Bennett, sales engineer, Garrett Burgess Inc., Detroit.

FIG. 2. THIS VIEW shows the actual riveting operation with the frame side rail member in the fixture. Hydraulic guns may be operated independently of each other due to the fact that each booster unit feeds only one gun. This permits better team coordination among operators and eliminates possible downtime caused by inter-locking devices.

FIG. 3. CLOSE-UP of a hydraulic 5:1 booster unit serving the Ford passenger car frame riveting line. This unit is used to raise the base pressure five times through means of differential areas, with a corresponding reduction in displacement. This booster unit is the automatic and reciprocating type.



and die repair or die changes due to product design changes were costly.

After a complete analysis of production requirements and costs, it was decided to build an experimental line powered by the individual hydraulic units. Operation of the pilot line was completely satisfactory from all standpoints. The old presses were removed and the new lines established.

Equipment cost for the pump and booster units was under the cost of a set of dies for the old press setup. Production is up about 10 to 15 percent. Because of the greater material handling problems presented by the press setup more men were previously needed. The new method, while calling for a man at each gun, has still resulted in fewer personnel, making it possible to better use the available manpower.

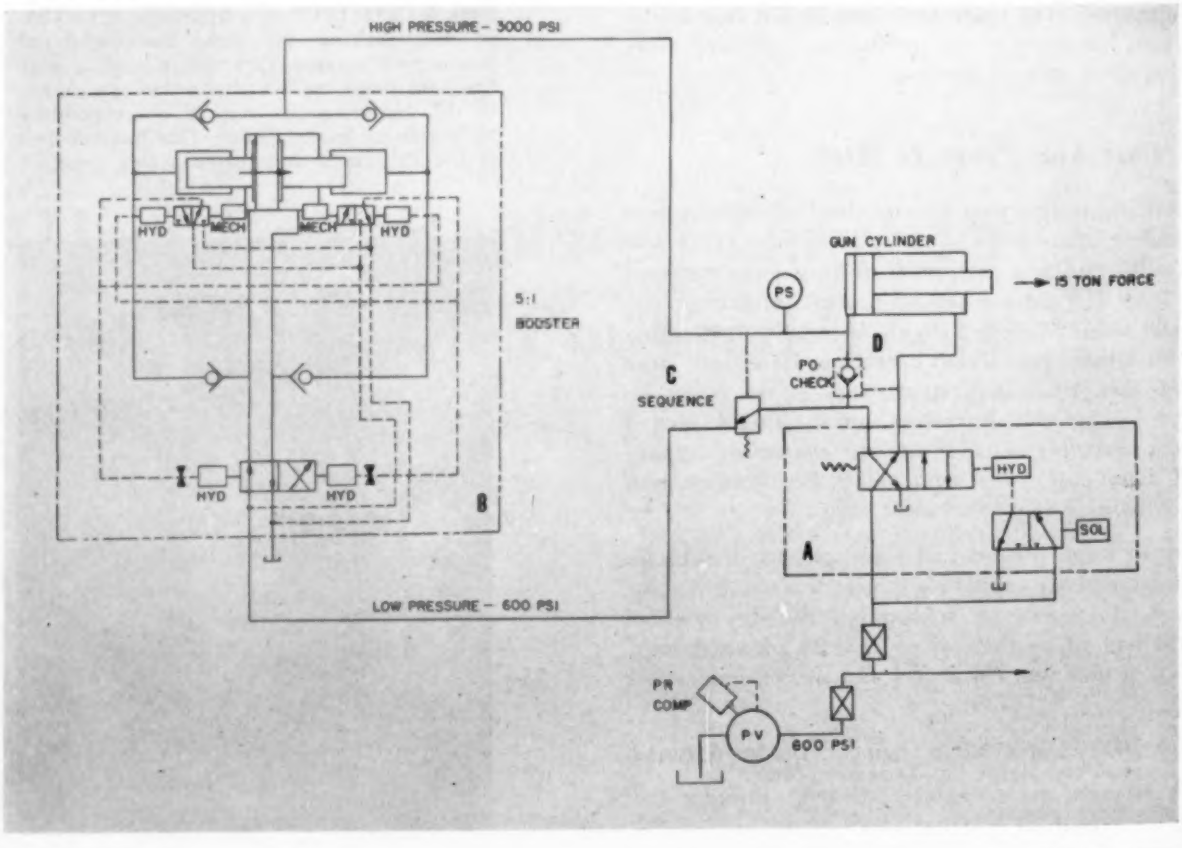
Hydraulic Circuit Layout

Design features of the new method are seen in the accompanying photographs and circuit. Low pressure entering the pilot operated solenoid controlled four way valve A goes through pilot operated check valve D into the rear of the riveting gun closing the jaws under low pressure and in rapid traverse. As pressure builds up due to resistance on the end of the gun, it causes pilot operated sequence valve C to open at the same time, because of pressure differential, the check valve D closes. Low pressure may then pass through valve C into booster B multiplying the low pressure at the rate of 5 to 1, which then is applied to the rear of the gun, causing the rivets to be upset.

When the maximum riveting pressure is met the pressure switch causes four-way valve A to deenergize allowing low pressure to go to the front or unclamping side of the gun, and at the same time pilot operated valve D opens so that the gun may retract and oil is discharged through valve D and A back to tank.

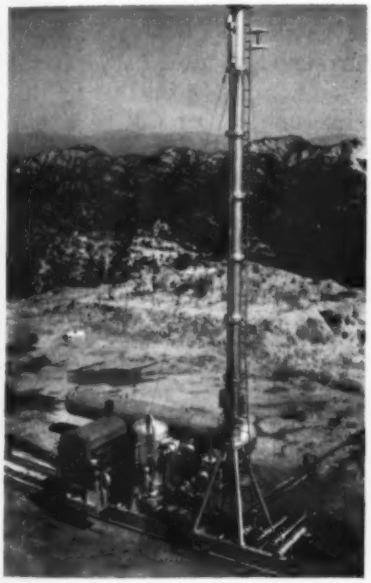
All of the riveting stations are identical to the one schematically shown in Figure 4. The commercial booster unit includes all the components shown within the dashed line housing of the circuit. Increased pressure is developed by the differential piston area. Check valves and hydraulically operated spool valves control oil flow within the booster. External connections require only the low pressure input, high pressure output, and drain to reservoir.

FIG. 4. EACH RIVET gun is powered by a separate booster unit as shown here. The variable volume vane pump supplies oil for 5 rivet guns. The high pressure line is between the booster outlet and the head end of the rivet cylinder. All other lines carry low pressure oil.



Oxidation of Petroleum Base Oils In Hydraulic Power Systems

By J. Theodore Wolff



Where unusually severe operating conditions are imposed on a hydraulic system, the power medium, usually a petroleum base oil is subjected to all the factors that cause breakdown or oxidation. This hydraulic long stroke pumping unit, used for the prime recovery of petroleum, operates under particularly severe conditions. The unit contains approximately 300 gallons of hydraulic oil which is used four times per minute. Pressures range from atmosphere to 300 psi per cycle and fluid temperatures may be as high as 185 F during the summer months.

Because of these severe operating conditions, the Axelson Manufacturing Co. has spent several years on a research project on hydraulic oils. Mr. Wolff's article presents a resumé of their findings.

IT has long been recognized that oxidation reactions are the most common and least understood of all reactions that may take place in petroleum hydrocarbons in common use. The sludge and gummy accumulations that occur in turbines and other heavy hydraulic equipment are most certainly in the main attributable to oxidation of the oil.

While petroleum base oils are ordinarily regarded as being resistant to the process of oxidation, they are nevertheless readily attacked by air and oxygen. Oxidation reactions take place by a series of extremely complex chain reactions. The large number of organic compounds involved and the various phases that they may pass through adds to the difficulty of a concise solution.

It is fairly well established that at medium temperatures (not in excess of 140 F.) the phases of reaction are the primary alcohols, thence on to the aldehydes and ketones and carbonyl carboxyl groups, which are the end products of highly complex chain reactions that ultimately result in the formation of what is commonly termed sludge.

Chemical analysis of this sludge indicates that the major portion is composed of free carbon, with lesser amounts of water, carbonic acid, aldehydes and some complex organic acids. Small amounts of acetic and

J. Theodore Wolff, Design Engineer, Axelson Manufacturing Company, Los Angeles, Calif.

What are the causes of oxidation?

How does oxidation breakdown the oil?

Can the rate of oxidation be controlled?

Will filters reduce the effects of oxidation?

formic acid have also been found which may produce esters with intermediate alcohols.

The hydroxylation theory has been advanced in the past on the basis that the primary oxidation step is taken when a hydrocarbon is involved in combustion with a combination of oxygen to form an unstable hydroxylated intermediate, such as methane adding an atom of oxygen to form a nascent methyl alcohol and another to give dihydroxymethane: the latter would lose water to give formaldehyde. The theory has been fairly well refuted due to the failure to find any traces of alcohols or glycols corresponding to the oxidized hydrocarbons.

It will therefore be seen that the complexities involved in the reactions and the lack of a fully substantiated theory would require recourse to some method of control or alleviation of the oxidation process.

The deterioration of some oils may begin, in extreme cases, within a very few hours. In the case of some motor oils where a crankcase temperature of 250 F is developed, the oil must be discarded within a period of 20 to 25 hours.

The main contributing factors to the oxidation of petroleum base oils are:

1. Oxygenation. (mixing of air with the oil)
2. High temperatures. (ranging above 140 to 250 F.)
3. High turbulence. (use of centrifugal pumps, jetting action, etc.)
4. Sunlight. (photo-catalytic action)
5. Progressive catalytic action, once initial oxidation has set in.
6. Water of condensation causing emulsification and subsequent oxidation.
7. Catalytic action of the non-ferrous metals.
8. Foreign contamination other than water condensation.

In general the oxidation process results in four major changes in the oil:

1. Darkening in color.
2. Increasing acidity.
3. Increasing viscosity. (hydraulic systems)
4. Precipitation of insolubles. (sludging)

Normally hydraulic oils are translucent to transparent and a reasonable indication of the rate of oxidation can be obtained from the progressive degrees of discoloration to the point of opacity.

Normal neutralization numbers of most inhibited hydraulic oils will fall in the range of .06 to .12 KOH Mg/Gm dependent on the type and amount of additive that is present. Viscosities may range from as low as 60 SSU to 260 SSU dependent entirely on the conditions involved in the hydraulic system and its application.

The initial stage of oxidation is nearly always indicated by a slight discoloration of the oil that will increase as the process intensifies. This will be accompanied by a drop in interfacial surface tension with a rise in viscosity, specific gravity and neutralization number. The rise in viscosity and acidity are not necessarily interdependent. Primary oxidation will cause a rise in acidity which will ultimately level off, at which point the viscosity may rise at an extremely rapid rate. This is probably due to oxidation products of high molecular weight which are held in fluid suspension. Most polynapthenic base oils are more apt to produce sludge at an earlier stage than those of a paraffinic base.

Effective Use of Inhibitors

In order to control or at least minimize the rate of oxidation, there are two major phases to be considered. These consist of periodic chemical and physical analysis of the oil, the use of the optimum amount of a compatible oxidation inhibitor and an adequate filtering system.

The importance of oxidation inhibitors or antioxidants has long been recognized in the field of organic chemistry. Some of the most effective of these are in the phenol group, such as, p-Aminophenol, Benzyl-p-Aminophenol, 2,6-Dimethylphenol and 2,6-Di-Tertiary-Butyl-4-Methyl-Phenol. Oxidation inhibitors are in themselves, oxidizable. The function of the oxidation inhibitor is purely to delay the oxidation process in the oil. Once the initial stage of oxidation has set in, it runs its course the same as in an uninhibited oil. The presence of non-ferrous alloys may tend to act as a catalytic agent to produce undue and rapid oxidation of the oil. Some experimentation has been done in this field by the use of small amounts of disalicylethylendiamine which acts as a counter-catalyst in retarding the action of copper and copper alloys. It is generally

conceded that the use of oxidation inhibitors will extend the life expectancy of the oil to more than 100 per cent of an uninhibited oil.

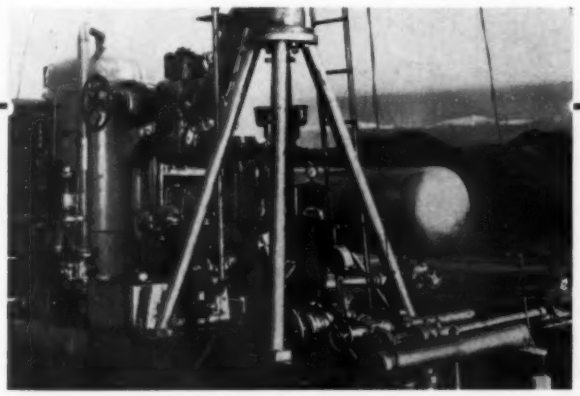
The use of an adequate filtration system is mandatory. The ordinary fabric or fibrous is not sufficient to contend with the various organic products engendered by the oxidation of the oil. This absorbent type of filter has a purely mechanical action and the material with which it is usually packed ultimately tends to channel and allows large particles of sludge and dirt to reenter the system without being retained in the filter. Completely adequate filtration can only be obtained through the use of a combined absorbent and adsorbent micronic filter. Oil passing through this type of filter not only has the suspended matter removed by the process of filtration, but also has the colloidally dissolved deterioration products, which would participate as varnish and lacquer upon the metal surfaces with further heat and oxidation, removed by the process of adsorption.

In any hydraulic system using a petroleum base oil as a power transfer medium, it is essential to maintain the temperature at a low level, preferably not in excess of 140 F. This is an important factor in the prolongation of the life of the oil. The type and rate of sludge formations differ with temperature levels. Most sludges formed at temperatures not in excess 140 F. are more apt to remain suspended in the oil, thus aiding filtration. They are also more easily soluble in a wide variety of commercial solvents and are therefore more easily removed when the hydraulic system requires cleaning. Retaining this low operating temperature is usually accomplished by the use of some type of heat transfer unit, such as an oil cooling radiator. This, however, is not economically feasible in all applications.

Design to Minimize Oxidation

At temperatures in excess of 140 F., particularly in the range from 140 F. to 250 F., the sludge deposits assume a gummy and tacky consistency and tend to compact into dense solids that are not too easily re-

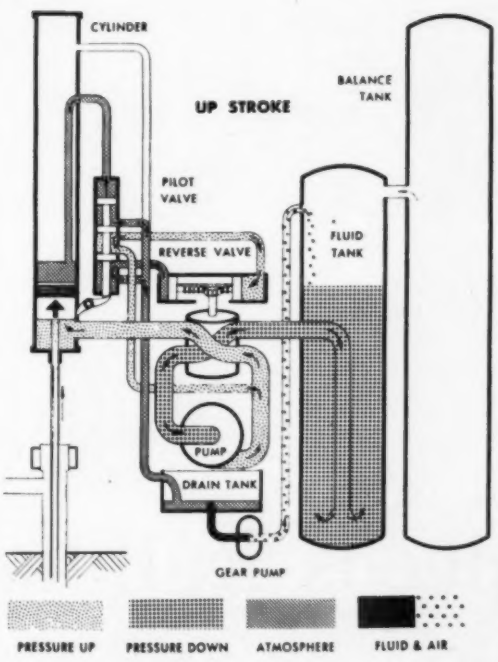
Concluded on page 92

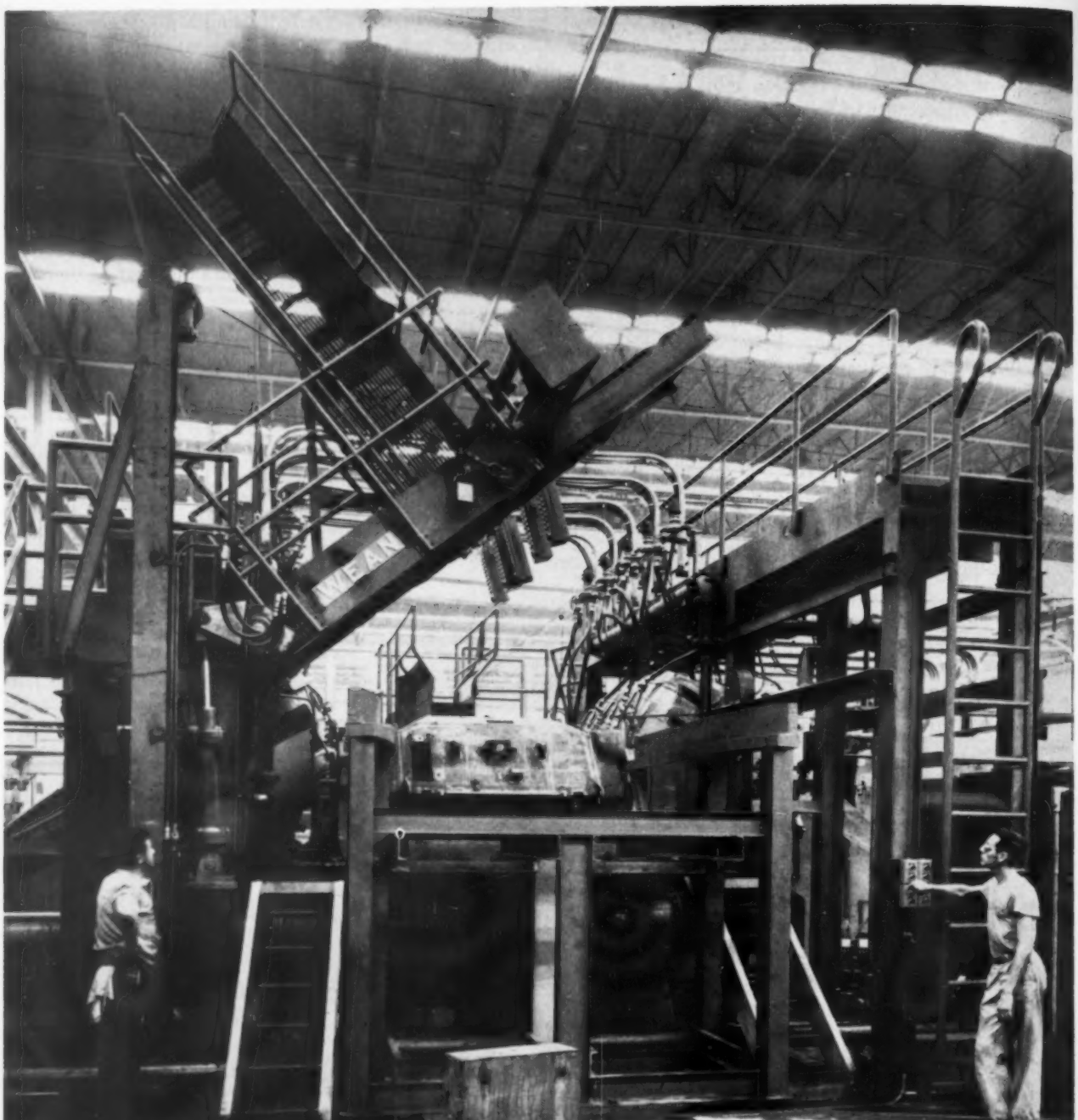


Operation of this oil well pump is out in the open, exposed to sunlight, condensation and foreign contamination. The control of oxidation is of prime importance if continuous production is to be maintained.

ON THE UPSTROKE, fluid from the discharge side of the centrifugal pump passes through the pilot valve and is directed to the right hand side of the operating piston of the reverse valve, moving it to the left. This movement rotates the plug valve 90 degrees through the rack and pinion.

Fluid under balance tank air pressure in the fluid tank passes through the reverse valve and centrifugal pump where its pressure is boosted and then to the hydraulic cylinder, lifting the piston with its load of rods and oil.





Multiple Circuit Grinder Speeds Bulldog Tank Production

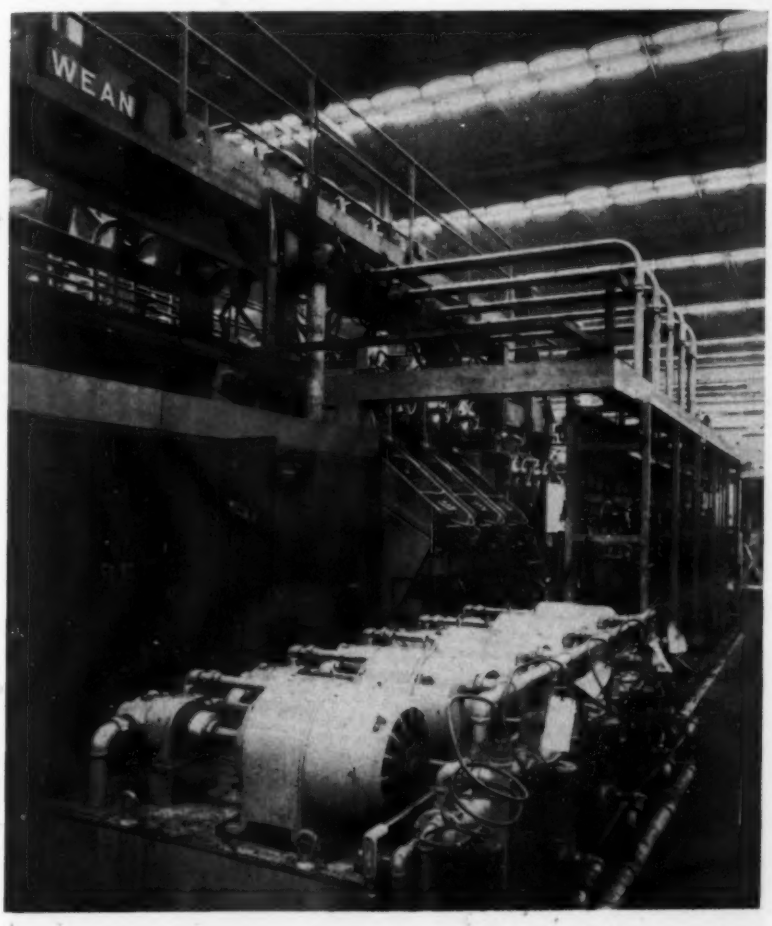
TANK HULL for the T-41E1 Walker Bulldog is seen in position for grinding the suspension mounting pads. The catwalks which had been lifted to permit loading are being lowered into place. An auxiliary hydraulic system powers the catwalks. The clevis mounted cylinder in the foreground raises the traverse section and a second cylinder moves the longitudinal section. A similar catwalk at the rear of the machine is in its lowered position. Note the pulley arrangement which serves to counterbalance the catwalk load.

PRODUCTION of armored vehicles introduces a new tooling aspect to men who are already familiar with high production automotive methods. Equipment must now be built to giant proportions as well as for production records.

The Cadillac Cleveland Tank Plant's largest machine tool, a Wean Grinding machine, is a striking example of industrial planning and design to efficiently handle a large part. Ten grinding heads, each weighing 10,000 pounds, are individually powered by separate hydraulic circuits.

This multiple-head machine which is the first completely automatic adaptation of a bank of grinding heads to work on an angular surface, grinds at one time all ten mounting surfaces for suspension assemblies on the underside of the tank hull. The job is done 22 times faster than when finished one pad at a time, on a horizontal boring mill.

While the finished machine, built in ten months by the Wean Equipment Corporation, of Euclid, Ohio, looks formidable and complicated, operation is extremely simple. An operator without any former ma-



FIVE, TWO-PRESSURE vane type pumps and their individual 15 hp electric motors are mounted on a 600 gallon tank. Each pump supplies one grinder head. Although all heads operate simultaneously, each is powered by an entirely separate circuit so that individual control is possible. Flow of cooling water through tube type oil coolers is regulated by the thermostatic control valves in the foreground. On this rear view of the valve panel, you can see that sufficient depth has been provided to assure accessibility. Special baffling of the tank assures maximum circulation between suction and discharge ports of all five pumps. There is an electric control panel on each side of the machine.

chine experience can be trained to run it in one day.

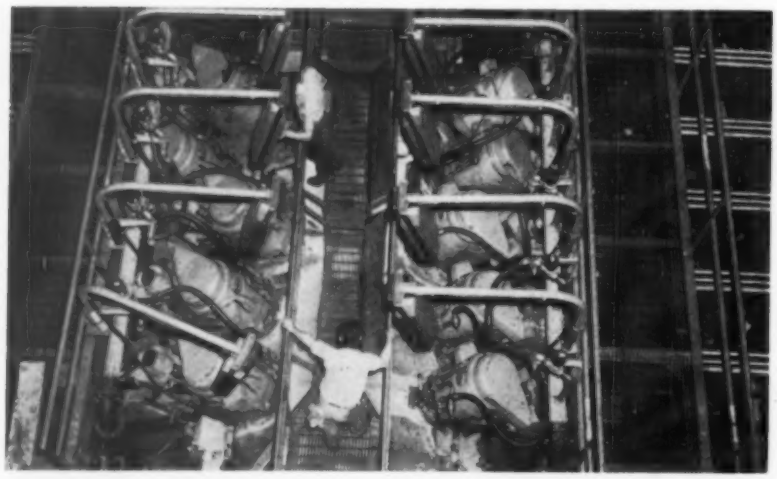
A separate 13 gpm, 1000 psi hydraulic system powers the catwalks and work supporting jacks. The catwalks are raised to permit lowering the tank hull into place. The jacks are moved in and a pressure controlled interlock insures proper holding pressure on the jacks before the grinding heads will operate.

Air Cylinders Power Dressing Tool

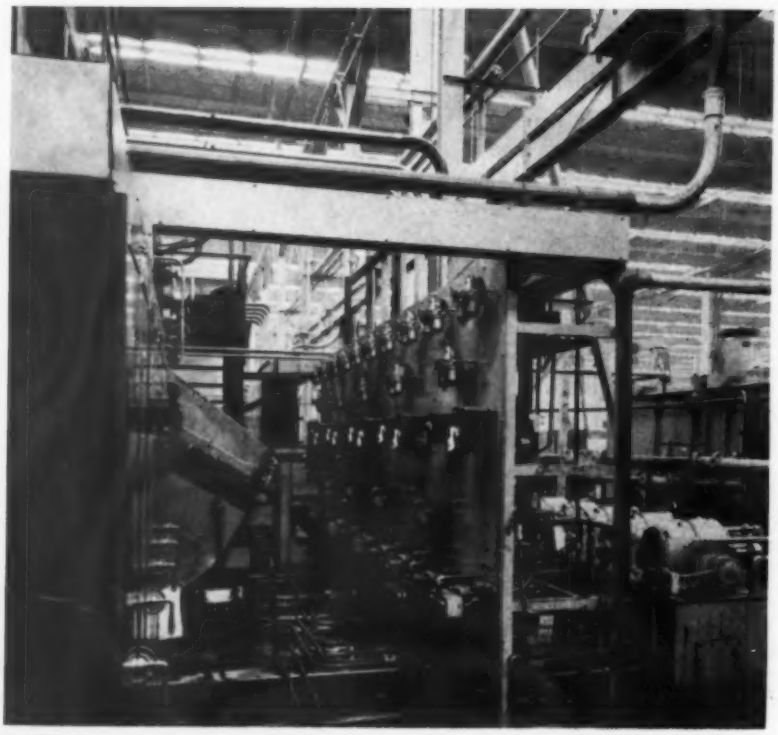
The machine cycle is completely automatic and safety interlocked. Actuation of almost 200 limit switches controls the sequence of operation.

Air power is also teamed with hydraulics and electricity on this 350 ton machine. Air cylinders are used to operate the clutch on the grinding head feed motor and to actuate the grinding wheel dressing tool. On each head, one air cylinder traverses the dressing tool into position to remove built-up residue on the wheel surface, and a second cylinder moves the dressing tool into the wheel, to do the actual dressing.

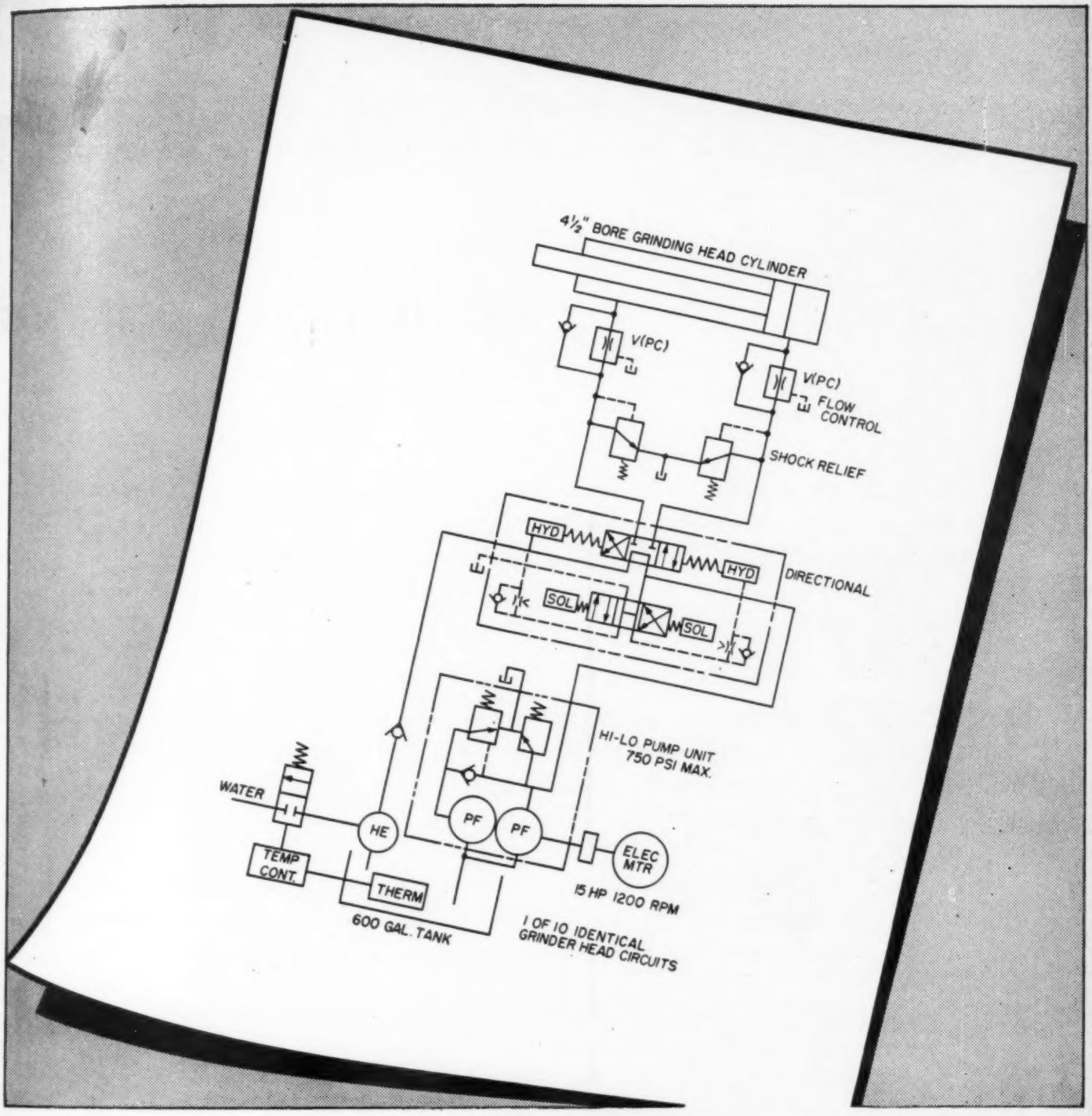
As hydraulic power traverses each head back and forth across the surface of the mounting pad, the feed of the grind is automatic. An electric motor, mounted on each head, operates a screw to provide this feed. When required depth is reached, the head withdraws and the circular motion of the abrasive wheel stops. Each head is remotely controlled from a pendant station located adjacent to the operators' cat walk.



FROM A SEAT in the overhead crane, you are looking down on the 10 grinder heads. The tank hull is positioned beneath the center catwalk. At each side of the two banks of heads are panels for the electrical, hydraulic and pneumatic controls which power each head independently.



ONE BANK OF FIVE grinding heads is controlled by the equipment seen here. On the front of the panel are the hydraulic directional and flow control valves. Along the top of the panel you see the pneumatic filter-regulator-lubricator units which regulate air to cylinders which power the clutch on the feed motors and the dressing tools for each grinding wheel. Having all the valves panel mounted, simplifies piping layout, thereby reducing maintenance problems. Pressure lines from the pumps go to the panel; lines to each traverse cylinder on the grinder heads are seen at the bottom of the panel.



SHOCK CONTROL at the end of each grinder head stroke was an important consideration in the development of this hydraulic control circuit. Each head, weighing 10,000 pounds, presents a large inertia load which must be decelerated and reversed without hammering.

Each of the 10 circuits is identical except for the length of cylinder stroke. Seven have a 45 inch stroke; two have a 49 inch stroke, and one has a 53 inch stroke. While the working or grinding stroke is approximately 27½ inches, the full stroke must be used to move the heads out of the way when loading and unloading the tank hull.

Three design details were introduced to prevent and relieve shock. By regulating the speed of reversal of the spool in the four-way, pilot operated solenoid controlled valve, the amount of oil delivered to the cylinder at the stroke ends can be reduced, thereby decelerating the cylinders. For this purpose, the lands on the valve spool are tapered to close off ports gradually as the valve shifts. Also the speed of spool reversal is controlled by built-in throttle valves. These small needle valves are adjustable to slow down the flow of oil from the spool ends as the valve is shifted in either direction.

To relieve any high pressure shock, two relief valves are used. If the shock load is greater than the relief setting, the valve opens to dump the oil to tank and prevent damage to the directional valve, pump and piping.

The double pumping unit offers an efficient means of supplying large volume low pressure oil for rapid travel and high pressure low volume oil for grinding.

Part I of a Series

By W. T. McCormick on "Good Practices in Designing and Building Hydraulic Power Systems"

Construction Hints for Hy

Nine general conditions or basic practices are listed and discussed briefly. This is the first of a series of articles dealing with procedures on design, construction, operation and care of hydraulic circuits applied to industrial machines.

THERE is no one set of rules or practice that will be satisfactory or adaptable to all applications. However, a specific pattern can and should be established which will govern design and construction, even though exceptions must sometimes be made or success may be unattainable or impractical for some applications and under some conditions.

A pattern of practices should include not only hydraulic, but electrical design and construction, mechanical preservation, interlocks, safety, choice of components, convenience of operation and maintenance and the removal, as far as is practical, of the human element.

With a pattern in effect, a basis is established upon which to improve and advance.

Close cooperation between mechanical and electrical designers and the hydraulic and electrical builders will tend to identify the probable problems that will present themselves. When each group has a basic knowledge of the other's field, mutual respect for each others problems resolves itself into an unwritten code for the application of the pattern. Time spent in this type of cooperation circumvents most normal problems and removes much human oversight.

or Hydraulic Equipment

Prepare elementary hydraulic and electrical circuits which will provide all necessary basic control. This will clearly show what the power and control problems are and very likely suggest more than one solution. Consider alternate solutions. There may be one that is simpler or better adapted to the job than the one you are most familiar with or are in the habit of using.

All controls handled by the operator are to be within his vision and convenient to his normal work station. Many accidents have been caused in the past by the operator reaching past a moving machine part. In other designs the operator had to traverse his machine repeatedly for each cycle. The fatigue this incessant moving about caused meant that as the operator slowed down so did production. A tired operator is a slow operator and, even more important, a careless one. This good practice rule is also specifically encouraged by the J.I.C.

Maximum velocity of the fluid in a line carrying the full volume delivered by the pump is not to exceed 15 feet per second. At this velocity friction, turbulence and shock are not too severe for most machine tool and production machine application. However, if the circuit is such that the full volume delivered by the pump is constantly and continuously utilized, it is well to reduce the velocity to 10 or 12 fps. These velocities are for both delivery and return fluid flow.

Choice of components will be based upon: (a) those which offer the most diversified adaptation; (b) those applicable to the widest range of pressure; (c) those constructed of the largest number and widest range of interchangeable parts; and (d) those available in a minimum number of sizes to meet most applications.

Personnel using, as well as those with authority to purchase hydraulic units, are to be thoroughly instructed in these features. The choice of components on a familiarity basis alone is not always good practice. New designs may be better for a given application; care must be exercised to avoid passing such designs by simply because the designer or builder is not familiar with their configurations or appearance.

The number of tubing sizes should be kept to a minimum. Five or six sizes, from $\frac{3}{8}$ inch to $1\frac{1}{2}$ inch OD, are sufficient for most delivered volumes. Within permissible limits of pressure and velocity the fewest number of sizes of tubing on a given system are always the most desirable. Volumes too large to be distributed by the sizes noted are to be carried by welded steel pipe. This reduces both tubing and fitting inventories.

All hydraulic and electrical components installed upon or within machine members are adapted, grouped and mounted upon a sub-plate or panels. This excellent practice, encouraged by the J.I.C. Hydraulic Standards for Industrial Equipment, facilitates service and maintenance, and reduces downtime. It also normally shortens distribution lines, facilitates stacking or manifolding of valves.

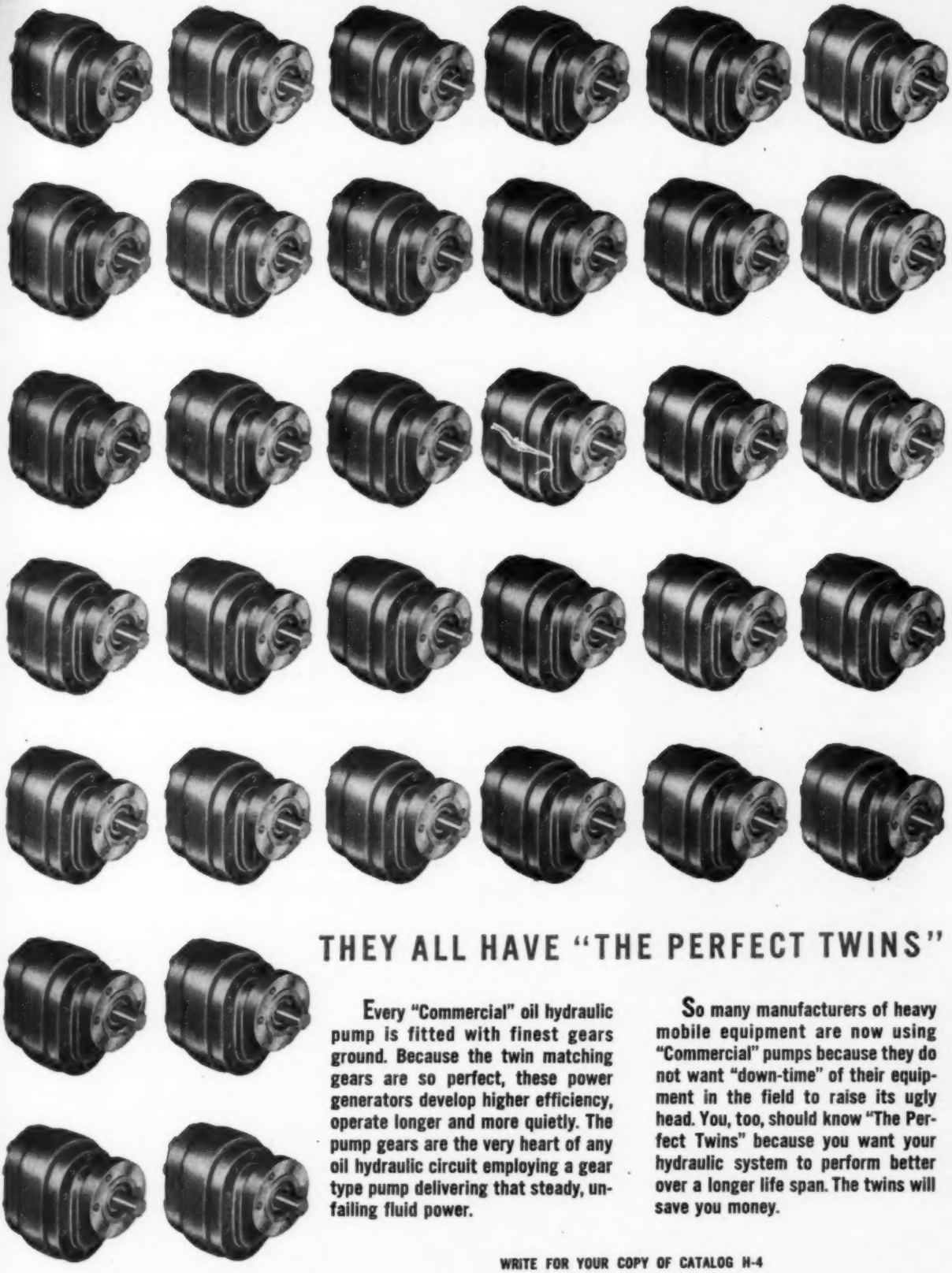
Redesign basic circuits to include all advisable interlocks and safety measures. Primary and secondary portions of a circuit that are dependent for their proper operation or functioning upon specific conditions in another part or parts of the circuit, must be interlocked to render those parts inoperative when improper operation may result in damage to the tooling, machine or the work or risk injury for the operator. Interlocks are especially important when a series of operations must be controlled in a strict sequence. On single purpose machines, perhaps the most common of all hydraulic applications, the future salvage of basic machine members is also an important consideration. Grouping of components, both hydraulic and electrical, and their mounting on panels, to facilitate removal and replacement for service or job changeover, is to be followed whenever possible.

Drain lines from similar components only should be combined. The number of lines that can be safely drained together can be determined by the combined internal area of their drain passages; this total area should not exceed the total area of the drain tube.

For example, for one make of equipment, four sequence, four flow control or four directional control valves of one type can be safely drained together. However, with the same equipment, only two directional control valves of different types should be drained together. In both cases, this rule holds for simultaneous operation. In general, two relief or two pressure reducing valves can be drained together. The number of drains from pressure reducing valves that can be combined is governed by their pressure settings and the frequency of pressure fluctuation in the part each controls. When in doubt drain independently. All drains should be returned to the reservoir in such a manner that their terminus is subject to atmospheric pressure.

The design arrangement of all components is to be symmetrical and balanced. Simple straight lines, arranged horizontally and vertically whenever possible are easy to install and to service. Such a simple plan of tubing and grouped control units is increasingly important due to the trend toward exterior, short lines in modern industrial machines.

Part 2 of this series will deal with reservoir design.



THEY ALL HAVE "THE PERFECT TWINS"

Every "Commercial" oil hydraulic pump is fitted with finest gears ground. Because the twin matching gears are so perfect, these power generators develop higher efficiency, operate longer and more quietly. The pump gears are the very heart of any oil hydraulic circuit employing a gear type pump delivering that steady, unfailing fluid power.

So many manufacturers of heavy mobile equipment are now using "Commercial" pumps because they do not want "down-time" of their equipment in the field to raise its ugly head. You, too, should know "The Perfect Twins" because you want your hydraulic system to perform better over a longer life span. The twins will save you money.

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If you got a new stamping job:

Would your present presses be the right size?

Is buying a new standard press the answer?

Should you farm the job out?

Or could special tooling be designed?

Whenever you take on a job of making a new part or a change in existing models you have to decide whether you should buy new standard machines, revamp old equipment, build special tooling or farm the job out. Here is how one company solved their tooling problem by going to oil power. It's a typical production job—one which you might have in your shop.

THE HYDRAULIC POWER pack is at the rear of the press. The operator moves one manual valve to control press operation.

HAVING a new stamping to produce, the manufacturing process engineer immediately considers his available punch press capacity. If his own presses don't have the tonnage or the speed or the right size bed, he's got himself a problem.

Should he farm the job out? Does the production run warrant the purchase of a press to handle this job? If management were to approve this capital expenditure, would the right size press be available? If he comes up with a "yes" to any of these questions, someone has to be prepared to make a good sized investment. Because the process engineer is "cost conscious" he starts thinking about a new approach to his tooling problem. Does he need a conventional press? Could he design special tooling at a fraction of the cost of a new press?

These were the questions that management and engineering at the Pollak Steel Company of Marion, Ohio were asking when they had to work out a setup for punching holes in a steel strip. The strips are roll formed from tough rail steel and vary in length up to 34 feet. Rectangular holes, as many as 24 to a strip, must be pierced, and some arrangement is required to vary the distance between hole centers. It would be an awkward job for any conventional press. To pierce all the holes on one press stroke would require a press with a large bed and a capacity of about 200 tons. The cost of such a press would be well over $100,000 and a press of this size is not readily available. Progressive punching on a small press would be impractical because of the irregular spacing.

The problem was presented to Planet Products Corporation of Cincinnati, Ohio, who set about to design and build a special hydraulic punch press.

Final design is shown in the accompanying photographs. Planet built the press at a cost of approximately $15,000. The use of individually oil powered punches provides a press which will handle all the required strip lengths and varying hole centers. Pollak designed, built and installed handling and painting equipment.

Four and a half inch bore, clevis mounted cylinders

How To Reduce Capital Tool Costs

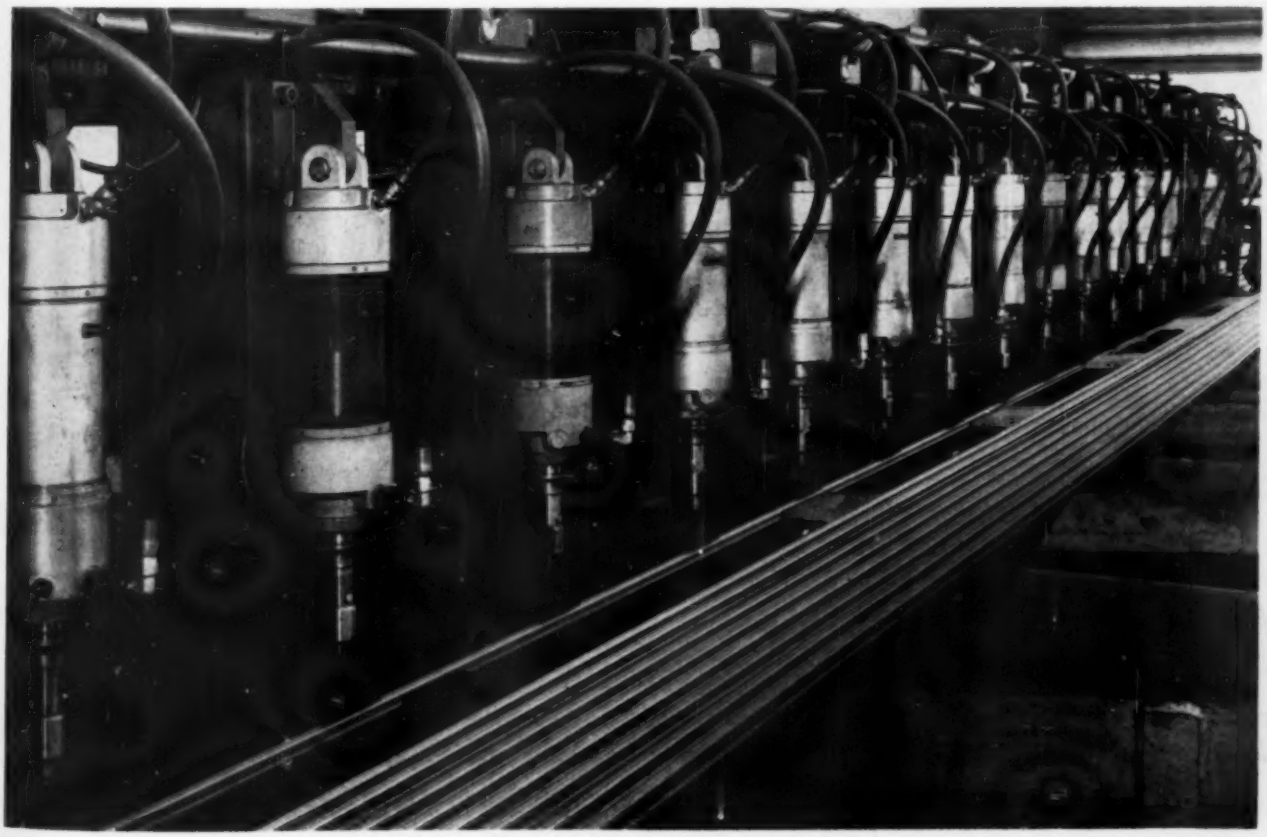
are used. Each punch, having a ¾ inch working stroke, floats in a 3 inch guide. Holes are punched to a ±.003 inch spacing tolerance. Each punch can be quickly disconnected from the power source. The use of flexible hose permits changing punch centers to a minimum of 5 inches, a limit set by the width of "I" beam to which each cylinder is mounted.

Hydraulic power is supplied by a power package seen at the rear of the press. A double pump is used to supply 41 gpm for rapid stroke and 5 gpm for the high pressure work stroke. On one setup, where 17 holes are punched, the complete cycle takes only 4 seconds. A low pressure relief valve is used in the cylinder return line to permit the pump to idle at low pressure during load and unload when the punches are up. The press is manually actuated.

A series limit switch circuit and indicator light are provided to insure that all stations have completely pierced the work before ejection. Operator safety was taken into account in designing the punching units. Because of the flat nature of the work piece, it was possible to restrict the size of the gap in the throat area so that it was inherently safe.

This oil powered press has solved a production problem with a low initial investment and has resulted in tooling which can be easily maintained and varied to suit the job. A very important advantage of this tooling has been the manner in which it fits into the production line. The press is very compact in comparison to any standard press. Considerable planning went into the necessary racks and conveyors which must move these long strips through the shop. The photographs clearly show how the design of this press fits into this handling procedure.

EACH PUNCH is powered by a separate cylinder. The cylinders may be moved or cut off the line very quickly to change the hole pattern.



HANNA CYLINDERS POWER SAHLIN "IRON HAND"

The Sahlin "Iron Hand," manufactured by the Sahlin Engineering Company, has become an important tool of mass production. Wherever drawing or stamping presses are used, the "Iron Hand" is often seen withdrawing formed metal parts in rhythm with the press cycle. It provides increased production and safety with decreased labor.

A contribution to the tireless, dependable operation of the "Iron Hand" is Hanna Cylinder Power. Economical, fast-acting cylinders with pilot valve control provide the ideal answer to press cycle synchronization.

Hanna Cylinders were selected by Sahlin because of their many outstanding design and construction features which insure uniform, dependable operating efficiency, long life and minimum maintenance.

Hanna Cylinders are used with confidence for all operations where cylinders are a vital link in the production flow.

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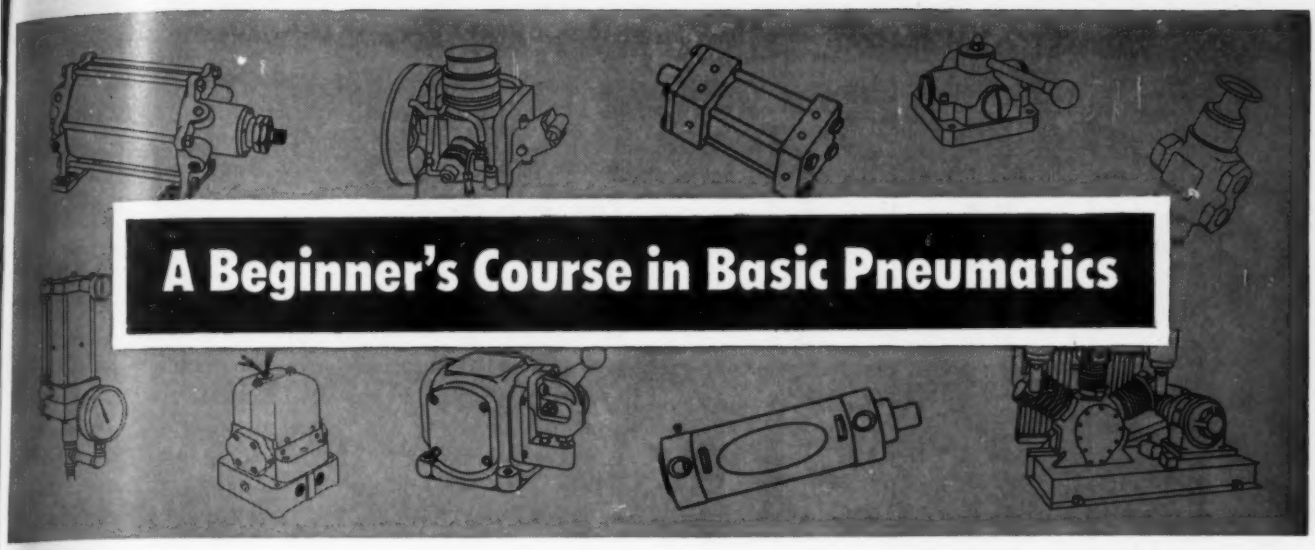


A Beginner's Course in Basic Pneumatics

Section I
Air Properties and Characteristics

Part III

Atmosphere and How We Use It

Our atmosphere or air is a mechanical mixture of gases, principally of nitrogen and oxygen (78 and 21 percent, respectively, by volume). For our purpose the weight and pressure of air are important. We will briefly discuss the basic relationship of these properties.

Air, as a gas, has weight. Our atmosphere may be considered a deep blanket surrounding the earth. The atmosphere at any point exerts a pressure because of the weight of the stack of air above it. The common reference point is sea level, where air exerts a pressure of 14.7 psi. This figure is used as a standard for making computations. The weight of pure air* at this pressure—standard or one atmosphere—at 32 F is .08071 pounds per cubic foot. This is by the same definition, a barometric pressure of 14.696 psi (14.7 psi).

Atmospheric pressure is equal in every direction at any given point of contact (Figure 1). For this reason, we move through the atmosphere at any given level

*Smithsonian Physical Tables, 8th revised edition, p 176.

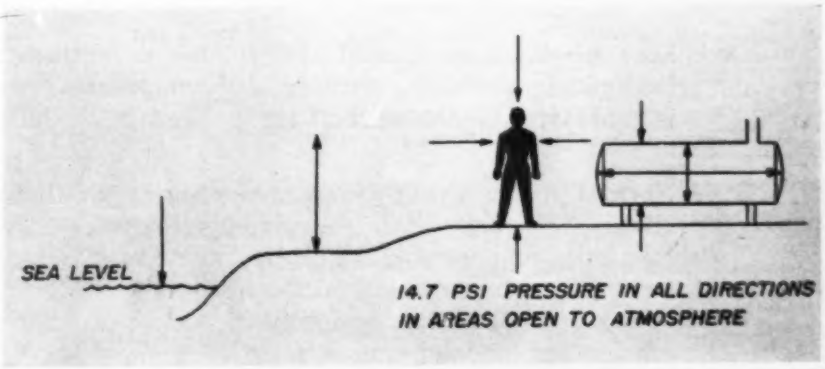


Fig. 1. THE ATMOSPHERE exerts the same pressure on both exterior and interior surfaces at the same elevation.

Altitude above Sea Level Feet	Atmospheric Pressure Lbs. Per Square Inch	Barometer Reading Inches of Mercury
0	14.69	29.92
500	14.42	29.38
1000	14.16	28.86
1500	13.91	28.33
2000	13.66	27.82
2500	13.41	27.31
3000	13.16	26.81
3500	12.92	26.32
4000	12.68	25.84
4500	12.45	25.36
5000	12.22	24.89
5500	11.99	24.43
6000	11.77	23.98
6500	11.55	23.53
7000	11.33	23.09
7500	11.12	22.65
8000	10.91	22.22
8500	10.70	21.80
9000	10.50	21.38
9500	10.30	20.98
10000	10.10	20.58
10500	9.90	20.18
11000	9.71	19.78
11500	9.52	19.40
12000	9.34	19.03
12500	9.15	18.65
13000	8.97	18.29
13500	8.80	17.93
14000	8.62	17.57
14500	8.45	17.22
15000	8.28	16.88

Fig. 2. TABLE of atmospheric pressures and barometric readings at various altitudes.

without being aware of the pressure. We are aware of changes in atmospheric pressure, particularly sudden changes, like those experienced by a sudden rise or drop in an airplane.

Because the atmosphere has weight and exerts pressure because of the depth of the atmosphere, atmospheric pressure is less at higher elevations above sea level. Figure 2 gives both atmospheric pressures in psi and barometer readings in inches of mercury for various altitudes above sea level. Conversely, at altitudes below sea level, atmospheric pressure increases.

The Barometer

Atmospheric pressure is measured by an instrument known as a barometer. Figure 3 illustrates the principle of the barometer. Since there is no air in the top of the tube above the mercury column, the pressure at that point is zero. The pressure reading equivalent to this mercury column is, therefore absolute pressure.

Absolute pressure is defined in several ways—it is pressure measured above a perfect vacuum. More commonly it may be considered atmospheric pressure plus gauge pressure. Gauge pressure is pressure above atmospheric pressure as measured by the standard Bourdon or spring type gauge. Such gauges are usually

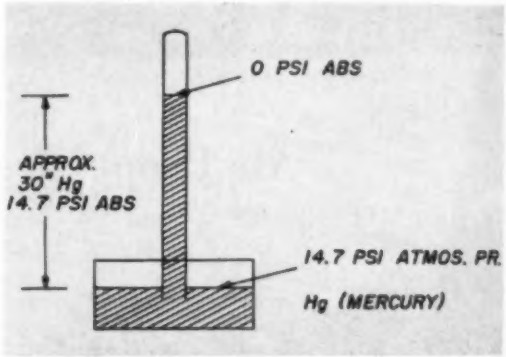


Fig. 3. THE BASIC PRINCIPLE of the barometer is shown schematically.

Atmospheric pressure is the force exerted by the weight of the atmosphere at any point.

Absolute pressure is pressure measured above a perfect vacuum; practically it is atmospheric pressure plus gauge pressure.

Gauge pressure is pressure above atmospheric pressure as measured on a standard Bourdon or spring type gauge.

Free Air is air at normal atmospheric conditions, i.e. standard variations due to barometric pressure, altitude and temperature are assumed. Practically, free air is considered as the normal air on the intake side of a compressor.

Normal Air is air at assumed average conditions of atmosphere in a temperate climate. The conditions assumed are that the temperature is 68 F; the relative humidity 36 percent; atmospheric pressure is 14.7 psi, density is .075 pounds per cubic foot; the ratio of specific heats is 1.3947. Normal air conditions are used to arrive at an average figure from which capacities, operating characteristics and efficiencies of compressors may be computed.

calibrated to indicate psi. Figure 4 illustrates the basic Bourdon gauge.

Absolute pressure at any point is the algebraic sum of the atmospheric pressure and the pressure indicated on the gauge or manometer. For example, if, at sea level, the gauge pressure is 20 psi, the absolute pressure would be 14.7 psi (atmospheric pressure) plus 20 psi

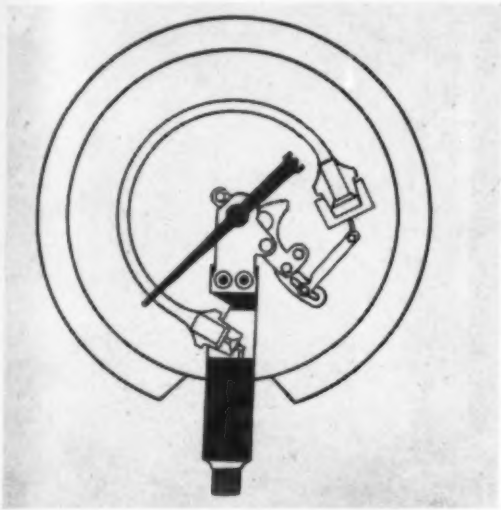


Fig. 4. A BASIC BOURDON GAUGE, which is used to indicate pressure above atmospheric. Such gauges are normally calibrated to indicate psi.

or 34.7 psi. Or take the case of a pressure below atmospheric. A given vacuum gauge shows 4 inches of mercury vacuum. Barometric readings in inches of mercury vacuum can be converted to psi by multiplying by the factor .491. To find the absolute pressure:

4 x .491 = 1.964 psi

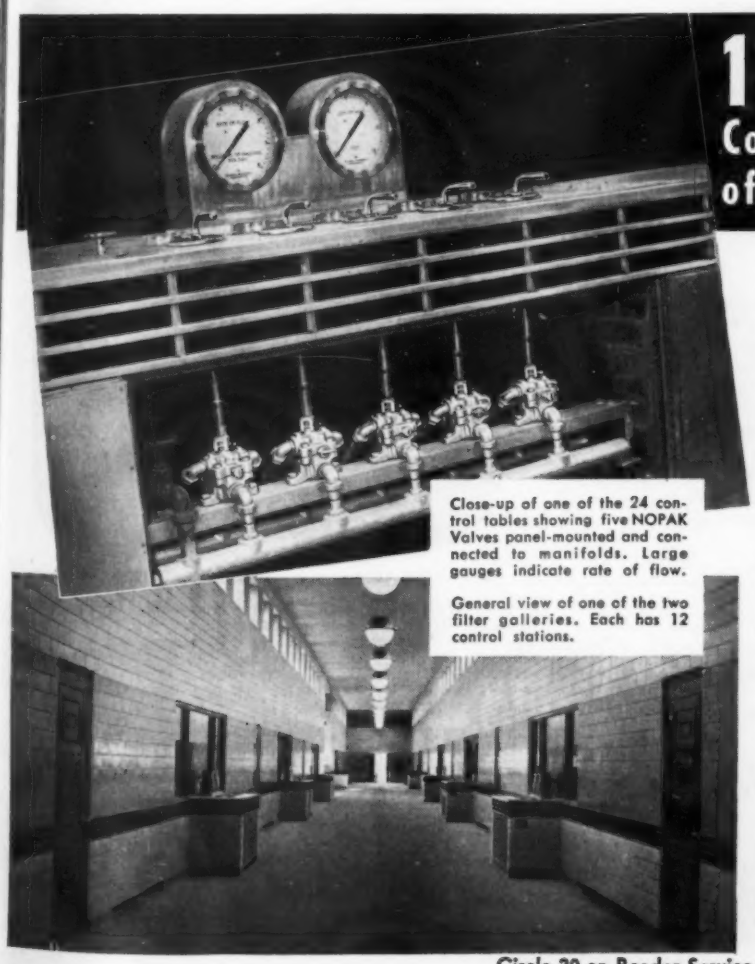
14.7 −1.964 = 12.74 psi absolute pressure.

Free Air and Normal Air

Free air is defined as air at normal atmospheric conditions. We have already seen that the pressure varies with altitude above or below sea level. Various weather disturbances, as well as altitude, causes fluctuations in the barometer. In addition temperatures have daily as well as seasonal variations. Free air therefore will vary with atmospheric conditions. However, for compressor work it may be considered as the normal air at the intake side of a compressor.

Because free air is a rather loose term, a more precise unit or definition is advisable. In an effort to arrive at an average figure from which capacities, operating characteristics and efficiencies of compressors may be commonly computed, the term normal air is used. Normal air is air at sea level (atmospheric pressure 14.7 psi), 68 F and relative humidity of 36 percent. The density is .075 pounds per cubic foot and the ratio of specific heats is 1.3947.

We have seen that our atmosphere exerts pressure and distinguished between atmospheric and absolute pressure; we have shown the relationship of altitude to atmospheric pressure and barometer readings; we have reviewed the basic principles of the barometer and the Bourdon gauge and we have defined free air and normal air.



Close-up of one of the 24 control tables showing five NOPAK Valves panel-mounted and connected to manifolds. Large gauges indicate rate of flow.

General view of one of the two filter galleries. Each has 12 control stations.

120 NOPAK Valves Control *Intake and Drain Gates* of Nottingham Filtration Plant

This recent major addition to Cleveland's water supply system, having a normal capacity of 100,000,000 gallons per day, employs water-hydraulic valves and cylinders wherever possible.

120 NOPAK ¾", 4-way, all bronze, 250 lb. type valves, panel-mounted . . . "fed" and exhausted through manifolds . . . actuate the double acting cylinders which open and close the *intake and drain gates* for filtration and backwash operations.

Five NOPAK Valves are mounted at each of the 24 table control stations. There are 12 stations in each of the two filter galleries, and one operator normally takes care of all 24 stations.

For Technical Data on NOPAK Valves and Cylinders, refer to Sweet's File for Product Designers, or write for Bulletin SW-1.

GALLAND-HENNING MFG. CO.
2743 S. 31st Street • Milwaukee 46, Wisconsin

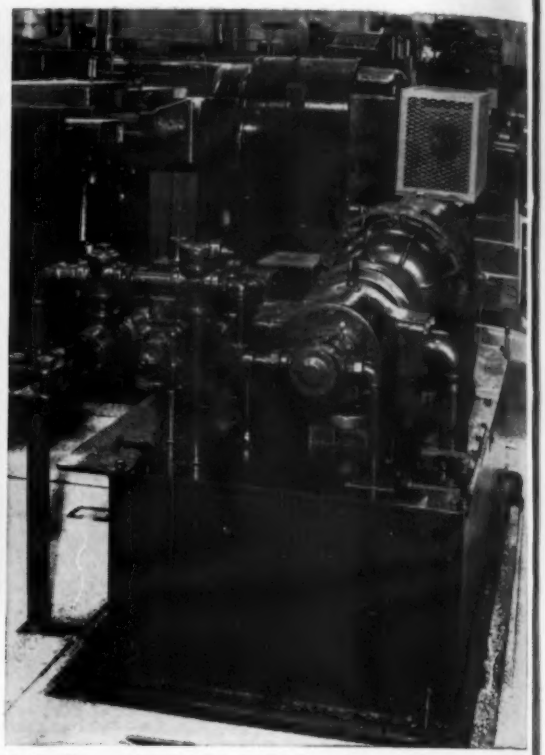
NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

Circle 20 on Reader Service Card

A 7095-½H

At UNITED STATES STEEL

Coil cradle on United States Steel Company's Irvin Works Three-Stand Cold Reduction Mill. Marvel Synclinal Filters are a part of the mill's main hydraulic system which operates this cradle as well as other hydraulic machines.



Hydraulic pump and tank on the recoiler hydraulic system of United States Steel Company's Gary Sheet and Tin Mill's Continuous Galvanizing Line. A Marvel Synclinal Filter is installed inside the tank on the suction line.

and with hundreds of others

MARVEL SYNCLINAL FILTERS

Protect Hydraulic Equipment

IN 1951 ALONE OVER 30,000 MARVEL SYNCLINAL FILTERS have been specified for installation on all types of hydraulic and oil recirculating equipment. In the plants of America's industrial giants as well as in the plants of smaller businesses, Marvel Synclinal Filters are doing a job protecting machines and increasing production. They are proving their superiority in the one real test—on the job. Records show Marvel Synclinal Filters operating longer between cleanings, requiring less attention, cutting down time, and in short, achieving more production with less maintenance. Not only plant operators, but also over 270 manufacturers of machines have recognized the superiority of Marvel Synclinal Filters and now install them as original equipment.

SUMP TYPE (Cutaway) LINE TYPE (Cutaway)

A SIZE FOR EVERY NEED in filtering non-corrosive liquids in hydraulic and low pressure systems. Sump and line type models available in capacities from 5 to 100 g.p.m. and in mesh sizes from 30 to 200. All models may be quickly disassembled, cleaned and reassembled on the spot by any workman. Line models operate in any position and are easily serviced without disturbing pipe connections.

★ **WATER FILTERS** In response to the great demand we have designed both our sump and line models for use in all water filtering applications.

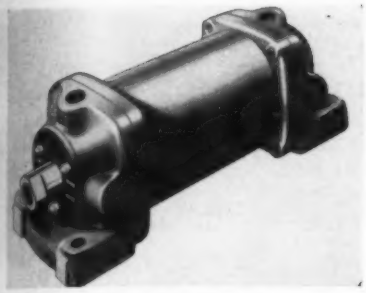
Write for Complete Engineering Data — Specify Oil or Water

Meets J.I.C. Standards

MARVEL ENGINEERING COMPANY
625 W. Jackson Blvd. Chicago 6, Ill.

Circle 41 on Reader Service Card

application and performance of NEW COMPONENTS



Air Cylinders

Rivett Lathe & Grinder, Inc., Boston, Massachusetts

Sizes: 28 different models, each in 9 bore diameters for pressures up to 150 psi. Available in 7 mounting styles, in any length of stroke up to 96 inches.

Design: Single or double end rods, with internal or external thread, and cushioned rod end, blind end, or both. Ample bronze rod guide; piston rod and assembly firmly secured; heavy-duty rod alloy covers, bored to fit a turned diameter on tube; self adjusting composition cup packing; seal effect proportional to cylinder pressure.

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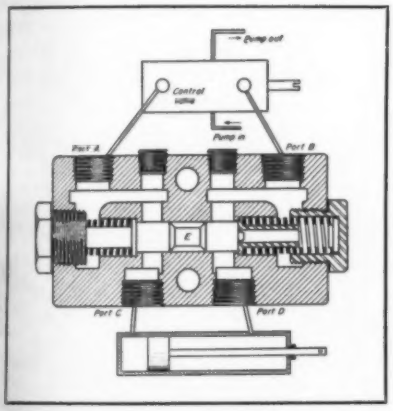


Hydraulic Regulating Valve

Hydraulic Equipment Co., Cleveland, Ohio

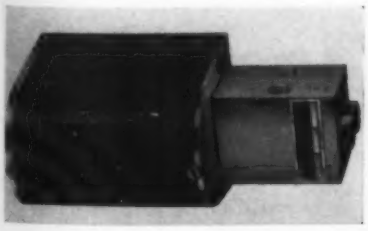
Designation: Model 450

Service: Designed to control the rate of travel of a double acting cylinder by eliminating hydraulic voids in cylinder operation. For use on cranes, road graders, lift trucks and other equipment where under certain conditions, the load tends to move the cylinder at rate such that the pump is unable to supply oil to the power side of the cylinder fast enough to prevent a void being created on that side.

Operation: Control of rate of cylinder travel is maintained by restricting the flow of scavenger oil from the cylinder of means of a plunger which is actuated by the pump line pressure.

Sizes: ½ or ¾ in ports for a maximum operating capacity of 14 gpm.

Circle 152 on Reader Service Card



Air Pilot Valve

Automatic Valve Co., Farmington, Michigan

Designation: 4-way model 412-250

Service: Designed for use on small double acting cylinders up to 3 in. dia. Gives satisfactory performance on a great many applications where it was formerly necessary to use a more expensive full ¼ in. valve.

Design: The valve is small, compact, light weight and made of noncorrosive metals and materials throughout.

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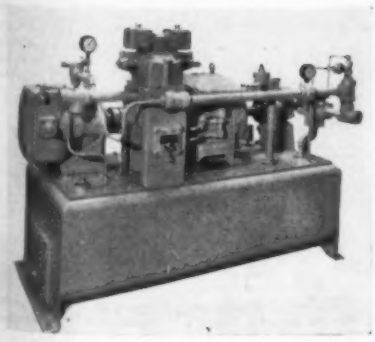

Hydraulic Power and Control Unit

The Rucker Co., Oakland, California

Size: Range to 125 hp to 5000 psi.

Design: These units incorporate a high-low pressure and volume pump, with a pressure compensated high pressure circuit to hold pressure cycle at exact speeds desired. Unit includes electric controlled valving, decompression unit, micronic filters, and large oil reservoir tank, sized to meet specific job needs.

Service: For conversion of older, slow-speed hydraulic presses and extrusion machines to higher speeds required by modern production.

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Circle 53 on Reader Service Card

HAND HYDRAULIC PUMP

Single and Double Designs To 20,000 P. S. I.

- **Dual Pump Unit Reservoir. 360 cu. in.**
- **Interchangeable Pistons**
- **Interchangeable Pistons 3/8-1/2-3/4 inch**

Pressure range is 3,000 to 20,000 P.S.I. Pipe connections 1/4" N.P.T. Handle length is 18 inches. Weight is 8 to 18 pounds. Unit can be bolted or welded into position.

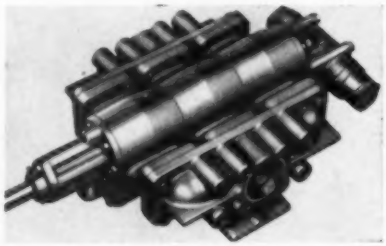
WILLIAM S. PINE
1637 E. 22nd St., Los Angeles 11, Calif.

Hydraulic Pump

Geo. D. Roper Corporation, Rockford, Illinois

Designation: Series K. Model 2k110 (Illustrated).

Application: For elevator service and similar pumping requirements.



Sizes: Capacities from 25 to 110 gpm at 300 psi.

Design: The pumping elements are two equal size helical gears. The gear design achieves efficiency and quietness of operation with smooth uniform flow. High lead bronze sleeve bearings support the hardened steel drive shaft. Bearing loads are distributed. The Roper venturi suction and discharge principle is designed in these pumps to reduce turbulence and improve efficiency. A built-in relief valve eliminates external piping, saves space and reduces the possibility of hydraulic noise.

Circle 155 on Reader Service Card

Air Warning Device

Airlarm, Houston, Texas

Designation: Model 140, "Airlarm"

Service: Sounds a shrill, continuous whistle when the pressure in any compressed air system falls below the minimum pre-determined pressure for safe or efficient operation of equipment.

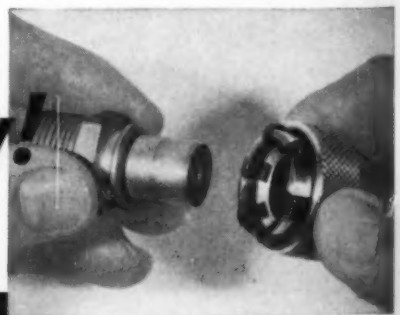
It is completely mechanical, fully automatic and entirely self contained. Recommended for appli-

Throw your wrench away!

CONNECT or DISCONNECT any fluid or electric line *without a wrench*

Wherever fluid or electrical lines must be joined or separated easily and quickly, you can rely on *WIGGINS Inst-O-Matic couplings*. No wrench; just use your fingers.

If you use couplings on fuel, oil, hydraulic, electrical, pneumatic, oxygen, acid or water lines, you can use this cost-cutting coupling.



PULL and the mating halves disconnect.

PUSH and the mating halves connect. Especially useful in hard-to-get-at places.

Wiggins
Aircraft Division
E. B. WIGGINS OIL TOOL CO. Inc.
3424 E. Olympic Blvd., Los Angeles 23

INST-O-MATIC COUPLINGS

SUBMIT YOUR PROBLEM

WIGGINS Inst-O-Matic couplings can reduce your costs. Write today. There's a qualified representative near you.

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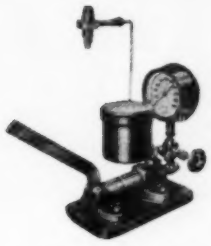
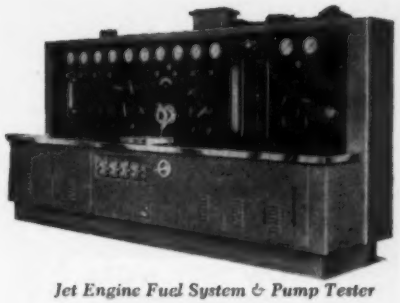
Hydraulic Accessories Test Machine

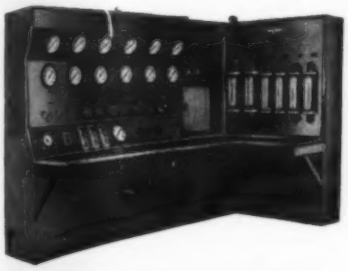


American-Bosch Nozzle Tester

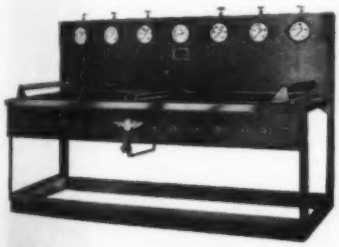
Oil Cooler Test Stand



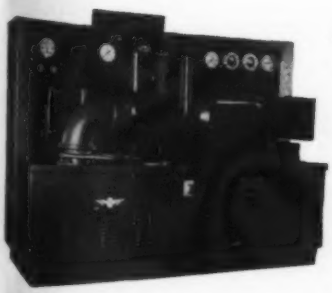
Jet Engine Fuel System & Pump Tester



Aircraft Leakage Test Stand



Boston Woven Hose Tester



Aircraft Heater Test Machine

It's your equipment... but it's our reputation!

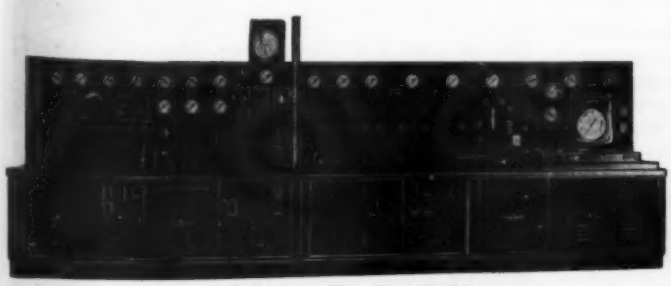
The pictures on this page show ten different test and maintenance machines produced by Greer. They are different in appearance. They are designed for different jobs. But they have at least three important things in common:

1. Each machine on this page was conceived, designed and produced by the same men. They are careful, dependable men who know their jobs, and their responsibilities. They are men with many years of experience in this very specialized field.

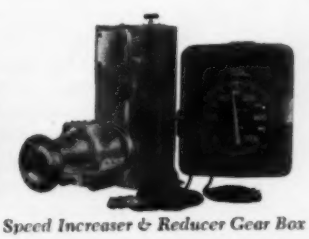
2. Each machine was painstakingly produced in a plant well known for its modern methods. Extraordinary precautions were taken at each step along the way to insure absolute accuracy.

3. Each machine can make or break a reputation . . . *our* reputation! That is why Greer stands firmly behind every piece of equipment sold. We cannot permit you to be dissatisfied with Greer equipment. Our reputation is worth far too much to us for that.

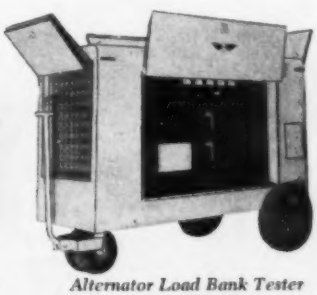
GREER
TEST EQUIPMENT
FOR AVIATION AND INDUSTRY



Laboratory-Type Test Machine



Speed Increaser & Reducer Gear Box



Alternator Load Bank Tester

GREER HYDRAULICS INC. · 454 EIGHTEENTH STREET · BROOKLYN 15, NEW YORK

Field Offices: Greer Hydraulics, Inc., 298 Commercial Building, Dayton, Ohio • 2832 East Grand Boulevard, Detroit, Michigan

Representatives: Thomson-Engineering Service, 708 Hemphill Street, Fort Worth 4, Texas • Harold E. Webb, 918 N. Kenilworth Avenue, Glendale 2, California

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UNBRAKO®
DRY-SEAL THREAD
PRESSURE PLUGS
HOW THEY WORK

Internal Root Crushes External Crest Here
JUST BEFORE HAND TIGHT
WRENCH TIGHT
External Root Crushes Internal Crest Here

without
SEALING
COMPOUND

When UNBRAKO Dry-Seal Pressure Plugs are tightened, the roots of the flattened threads *crush* the sharper crest of the mating parts. Both major and minor diameters are positively sealed and pressure-tight without sealing compound. Write for descriptive literature. STANDARD PRESSED STEEL Co., Jenkintown 2, Pennsylvania.

UNBRAKO SOCKET SCREW DIVISION
SPS
JENKINTOWN PENNSYLVANIA

cations where the service conditions are severe and noise level is high, such as construction and mining machinery, steel mills and oil field drilling rigs.

Operation: The assembly consists of a valve element which opens automatically when air line pressure drops below a preselected value. This allows escaping air to blow a whistle which is an integral part of the unit.

Circle 156 on Reader Service Card

Aircraft Pneumatic Check Valve

The Cornelius Company, Minneapolis, Minnesota

Service: Designed specifically for aircraft pneumatic service,

will not leak at any pressure up to 4500 psi.

Materials: Available in aluminum or stainless steel.

Design: Streamlined poppet and "straight through" flow of air provide high flow capacity with minimum pressure drop. Rubber seat positively positioned and retained to prevent "wash out" during high surge flow conditions. Meets the surge flow test requirements of specification MIL-V-5524A for hydraulic check valves using fluid conforming to specification MIL-O-5606. Due to large seating area, the valve performance is not affected by foreign particles or ice formation on the seat.

Circle 157 on Reader Service Card

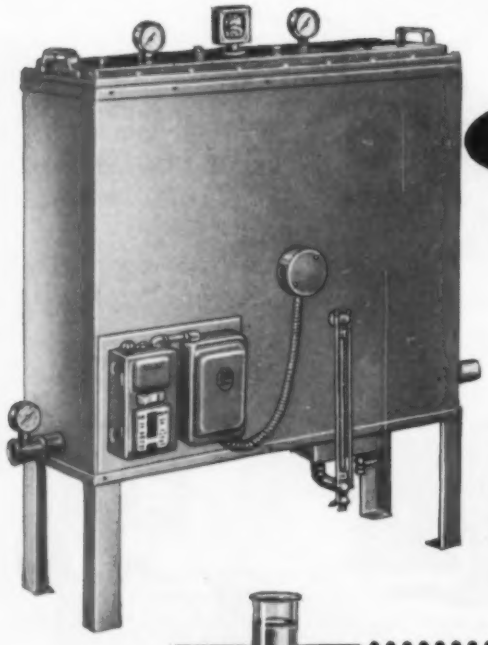
Pneumatic Couplings

E. B. Wiggins Oil Tool Co., Inc., Los Angeles, California

Service: For oxygen systems, missiles and gun chargers where a quick disconnect and connect under high pressures is desired.

Design: When one of the mating

complete WATER REMOVAL AND OIL FILTRATION
for all types of HYDRAULIC *equipment*



with the New Houdaille DRI-PURE water-oil separator

Actually Filters Oil as it Separates Water

The DRI-PURE removes solid contamination, acids and other sludge-forming products of oxidation as it separates the water. Eliminates changing or discarding of oil regardless of the type of contamination.

Write today for full details. Equipment bulletin available upon request.

Now, for the *first* time, an amazingly simple, practical, new unit for *automatic, continuous* water removal and oil filtration in all types of hydraulic equipment. New DRI-PURE reduces water content of oil to an insignificant trace . . . keeps oil clean and safe to use indefinitely! The DRI-PURE is easy to install, completely automatic in operation. Eliminates downtime and repairs . . . quickly pays for itself in oil savings alone.

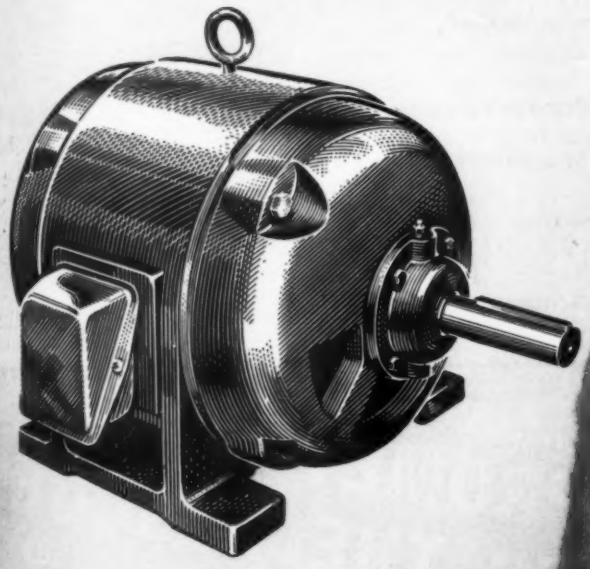
WORLD'S LEADING OIL FILTER MANUFACTURER

Honan-Crane Corp. 110 Sixth Street, Lebanon, Indiana
a subsidiary of Houdaille-Hershey Corp.

ELECTRO DYNAMIC

INDUSTRIAL MOTORS

Bred for BRAWN



For over 70 years extra strength and stamina have been bred into Electro Dynamic motors to fulfill the most exacting demands of industry.

To give added years of dependable, low-cost operation, special skills and superior insulating materials are used to toughen the WINDINGS... "the heart of the motor." The frames and housings are of rugged cast construction for rigidity and resistance to corrosion.

You'll find an E. D. motor for every requirement. All standard enclosures . . . 1 to 250 h.p. *Write today for illustrated literature.*

E. D. also makes a complete line of Direct Current Motors and Generators. Literature on request.

Industry has learned what marine engineers have known since 1880

ELECTRO DYNAMIC builds great motors

ELECTRO DYNAMIC · Division of Electric Boat Company · Bayonne, New Jersey

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SIMPLIFY EQUIPMENT CONTROL

WITH Ledeen CYLINDERS

Ledeen **CYLINDERS**

For straight line power movement. Air, oil or water operation. Medium Duty, Heavy Duty, and Super Duty models.

Write for Bulletin 500.

Ledeen **VALVES**

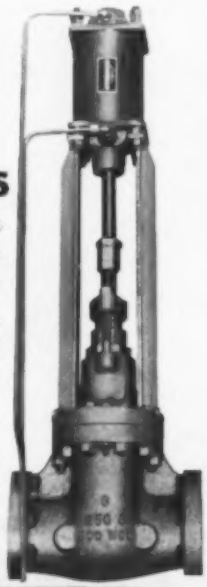
For actuating air or hydraulic cylinders. 14 different models for 5 different cycles, in 6 sizes. Hand, foot and power operated.

Write for Bulletin 510.

Ledeen **VALVE ACTUATORS**

For actuating any make, size and type of valve, against any line pressure, on any fluid medium, and with any pressure available. For on-and-off or positioning service. Positive in action, economical in cost.

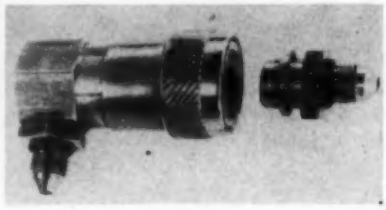
Write for Bulletin 512.



Ledeen Mfg. Co.
1610 So. San Pedro St.
Los Angeles 15, Cal.

Circle 34 on Reader Service Card

halves is pulled away, a unique valve closing action takes place which prevents loss of any pressure in the line. When joined,



this self locking action of the "dogs" insures a positive connection. The product, made of aluminum alloy, measures less than two inches in length, has a diameter of less than one inch and weighs under two ounces.

Circle 158 on Reader Service Card

Pilot Operated 4-way Valve

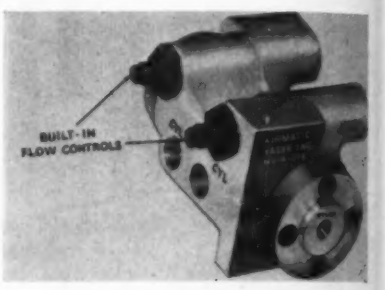
Airmatic Valve, Inc., Cleveland, Ohio

Designation: Aircontrol valve, model MV-4-375

Service: For use with air, oil or water at pressures up to 150 psi.

Sizes: Standard pipe sizes of ¼ ⅜, ½ and ¾ in.

Features: Said to eliminate insufficient pressure or excessive dwell in air cylinders of 6 inch diameter or more, the new valve is ideally suited where larger bore air cylinders are used in certain assembly methods such as crimping and staking. Rather than rely on the operator's judgement in controlling the



valve for the correct amount of cylinder pressure, the pilot operated, 4-way master valve is used

PROMET COMES TO THE RESCUE

TEMPORARY LUBRICATION FAILURES NEEDN'T BE EXPENSIVE

Medium and High-Lead

PROMET THE Engineered BRONZE **BRONZES**

No. 1, No. 2-S, No. 6, No. 6-SK, carry on until lubrication can be restored.

Hard and strong enough to take the constant pounding of heavy shock loads and high compressive forces, these Promet Bronzes are also sufficiently high in lead content, soft enough, to prevent seizure and to embed harder particles that would ordinarily result in scoring.

Easily machined at high speeds without lubricants or coolants.

Write today for service data sheets and quotations.

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Circle 50 on Reader Service Card

HYDRAULIC VALVES

Pathon

HYDRAULIC CYLINDERS

• WRITE today for literature covering Pathon's new Solenoid Controlled Pilot Operated Hydraulic Valves, Bulletin No. 15 and/or Hydraulic Cylinders, Bulletin No. 17.

PATHON MFG. CO.
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CINCINNATI 14, OHIO

SAVE UP TO 85% in WAR SURPLUS HYDRAULICS

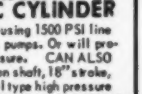
SPECIAL BARGAIN #29 HYDRAULIC CYLINDER

Gives 20,000 lbs. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lbs. thrust with 3,000 lbs. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1¾" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road farm and shop machinery, presses, etc. Cost Government $390.00 . . . . . NOW **29.95**

3A HYDRAULIC CYLINDERS

NO. 3A – Bore 1½", Shaft ½" Stroke 5", Length 10½" . . . **7.75**
NO. 9E – Bore 1-3/8", Shaft 1" Stroke 15-5/8", Length 15⅜" . . . **9.75**
NO. 35 – Bore 1½", Shaft 1" Stroke 26", Length 23½" **16.50**

HYDRAULIC TRANSMISSION



Salt contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever,) supplying piston hydraulic motor. Automatic pressure. Dash pot for smooth control. Power output R.P.M. – 0 to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicater Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2 - 4" Spline Shafts for input and power take-off. Cost Government approx. $400.00 **37.50**

AN-Hi-Press. HOSE (FUEL–OIL & AIR)

1/4" Tube Size – 7/16 x 20 Thread – 16" long with male and Female fitting at either end. . .95¢ each.
1/4" Tube Size – 7/16 x 20 Thread – 22" long with Female fittings at both ends, ...95¢ each.
3/8" Tube Size – 9/16 x 18 Thread – 20" long with Female fitting at both ends. . . . . $1.90 each
Same as above but 63" long. . . . . $3.75 each
1/2" Tube Size – 3/4 x 16 Thread – 24" long with Female fittings at both ends. . . . . $2.25 each
Same as above but 67" long. . . . . $3.75 each
5/8" Tube Size – 7/8 x 14 Thread – 15" long with Female fittings at both ends. . . . . $2.25 each.

HYDRAULIC PUMPS
ANGLE PUMP

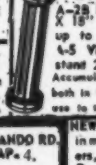
Positive displacement type, angle piston. Displaces .507 cu.in. per revolution. Has capacity of 6 gal. per minute at 3000 RPM at 1500 PSI continuous 1875 for 15 seconds. Operating speed of 3750 RPM. intermittent maximum 4500 RPM. Rotates to the right only. **19.49**

P-3 STRATO POWER PUMP With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. Two gal. per minute capacity at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous. 1400 PSI for 15 seconds. Operates at 3750 RPM, intermittent max. 4500 RPM. Rotation either direction without adjustment. NEW **17.50**

FOUR WAY VALVE

V-17 Poppet type. Pressure balanced. Off at neutral position. Piston type with built-in relief valves for limit of cylinder strokes. Has 5/8" AN tube size (7/8"–14 thread) inlet and outlet. Ports to the cylinder are 1/2" AN tube size with 3/4"–16 thread. Many more in stock. Send for list. **9.75**

HYDRAULIC ACCUMULATORS



A-28 FLOATING PISTON TYPE – 4" dia. X 18" long. Handles pressures up to 2000 lbs. Xlnt. Cond. **12.75**
4-5 VICKERS – 10" dia. Built to stand 2,000 PSI. **19.75**
Accumulators are used for constant pressure both in line and reserve storage for instant use to take the lag from the pumps.

We carry the World's Largest Supply of New Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes & Types. Can also supply all accessories such as Pumps, Fittings, Valves, Tanks, Hose Fittings. Let us solve your Hydraulic problems. Write for inform.

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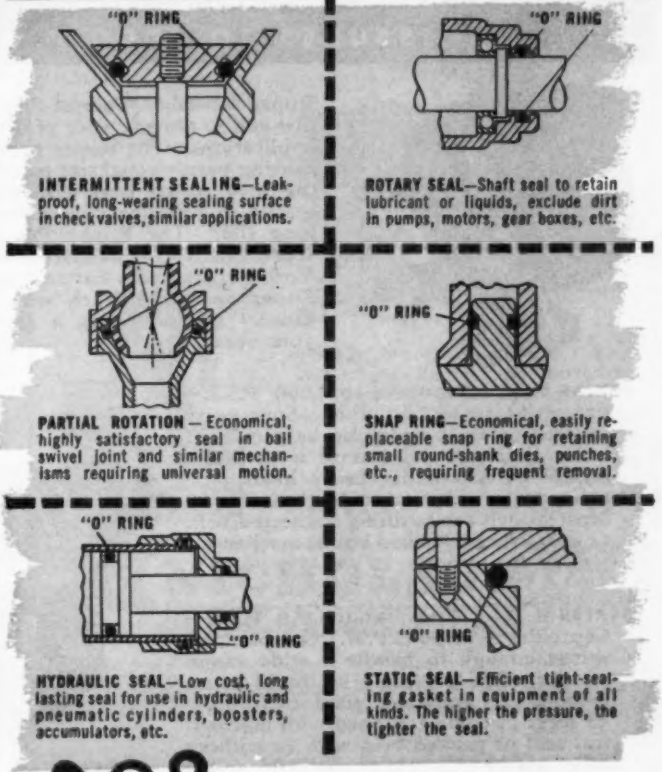
DEPT. AP-4,
GLENDALE 1, CALIF

NEW CATALOG–230 PAGES of BARGAINS in machine tools (taps, drills, dies, reamers, etc.). Hydraulic Cylinders, Valves, Pumps & Motors. Air Tools & Bearings. Send for your FREE COPY – TODAY!

Circle 49 on Reader Service Card

engineers designers OK

Arrowhead "O" rings



INTERMITTENT SEALING—Leakproof, long-wearing sealing surface in check valves, similar applications.

ROTARY SEAL—Shaft seal to retain lubricant or liquids, exclude dirt in pumps, motors, gear boxes, etc.

PARTIAL ROTATION — Economical, highly satisfactory seal in ball swivel joint and similar mechanisms requiring universal motion.

SNAP RING—Economical, easily replaceable snap ring for retaining small round-shank dies, punches, etc., requiring frequent removal.

HYDRAULIC SEAL—Low cost, long lasting seal for use in hydraulic and pneumatic cylinders, boosters, accumulators, etc.

STATIC SEAL—Efficient tight-sealing gasket in equipment of all kinds. The higher the pressure, the tighter the seal.

"O" RING APPLICATIONS are as varied as mechanical detail in machinery. Whatever your sealing problem, Arrowhead engineers and technicians are ready to advise you on the proper use of Arrowhead "O" rings.

All standard sizes in both dynamic seal and static seal gasket types are available, precision molded from Arrowhead's commercial compound. Arrowhead research has developed special compounds of natural, synthetic and silicone rubbers to meet unusual and difficult conditions of temperature, pressure and resistance to fluids and gases.

Get certified Arrowhead "O" ring service; write for the name of your nearby Arrowhead Sales Engineer.

WRITE FOR "O" RING MANUAL and data sheets designed to assist you in the selection of the proper ring and the most suitable compound. Write Dept. A-200.

"O" RINGS
AIRTRON DUCTS
ARCOSIL SILICONE RUBBER PRODUCTS

ARROWHEAD RUBBER COMPANY
Division of National Motor Bearing Company, Inc.
DOWNEY, CALIFORNIA (Los Angeles County)
FIRST commercial manufacturers of precision "O" rings, PIONEER fabricators of silicone rubber, ORIGINATORS of rubber-fiberglass ducting.

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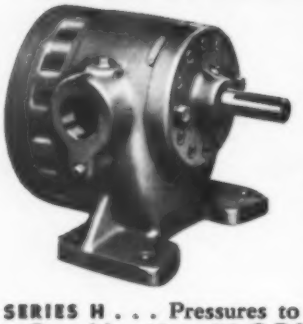
LIFT LOWER PUSH PULL

...for Dependable Hydraulic Service, install ROPER Rotary PUMPS

PRESSURES TO 1000 P.S.I.



Roper *dependable* Pumps! Smooth running units that add to the efficiency of diversified hydraulic applications. The Roper principle of only two moving parts—equal size pumping gears operating in a sturdy case with proper clearance—results in superior serviceability and promotes long life. The Roper Pumps illustrated are representative of standard pumps suitable for most installations. For unusual applications, let Roper engineers work with your design engineers in developing a special Roper to fit your needs.

SERIES H . . . Pressures to 1000 P.S.I.—Capacities 10 to 75 G.P.M. Spur gears operate in axial hydraulic balance . . . roller bearings and bronze wear plates reduce friction under heavy loads . . . splined drive shaft absorbs thrust loads. Most models can be direct connected, belt, or gear driven. Packed box or mechanical seal.

SERIES K . . . Pressures to 150 P.S.I.—Capacities ¾ to 50 G.P.M. Compact, yet sturdy enough to handle a wide range of jobs. Self-lubricated by liquid being pumped . . . handle total suction lifts up to 25 feet . . . come equipped with mechanical seal or packed box, with or without relief valve. Easy to install and apply.

SEE OUR CATALOG IN SWEET'S

SERIES F... Pressures to 300 P.S.I.—Capacities 1 to 300 G.P.M. Popular pumps that feature 4-port design (eight optional piping arrangements, 4 for clockwise and 4 for counter-clockwise rotation.) Supplied in standard or stainless steel fitted models to suit specific needs. Furnished with or without relief valve, with mechanical seal or packed box. Ideal for hydraulic power generation in a wide range of applications.

ROPER Rotary Pumps

Send for New Catalog 952

GEO. D. ROPER CORPORATION
704 Blackhawk Park Avenue, Rockford, Illinois

☐ *Please Send New Catalog 952*

NAME_____

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CITY_____

COMPANY_____

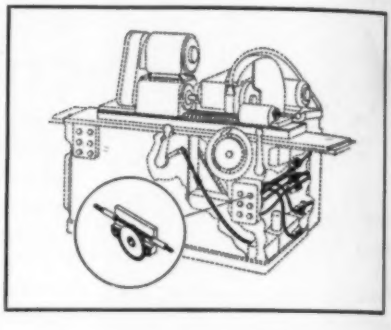
Circle 58 on Reader Service Card

in conjunction with two auxiliary bleeder valves. The momentary operation of either of the bleeder valves causes a shift in the valve spool, resulting in movement of the double acting cylinder piston.

Circle 159 on Reader Service Card

Remote Controls

Teleflex, Incorporated, Philadelphia, Pennsylvania



Service: A mechanical remote control system for transmitting motion of force from one point to another by movement of flexible cable within conduit. Used to remotely position and operate hydraulic and pneumatic valves.

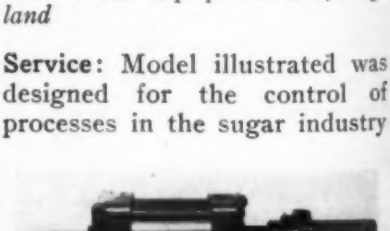
Design: The cable has an outer wire of comparatively large diameter wound around the main body of the cable. This screw type design reduces friction to a minimum and permits push-pull motion through bends for considerable distances.

Circle 160 on Reader Service Card

Special Air Cylinder

Marton Air Equipment Ltd, England

Service: Model illustrated was designed for the control of processes in the sugar industry



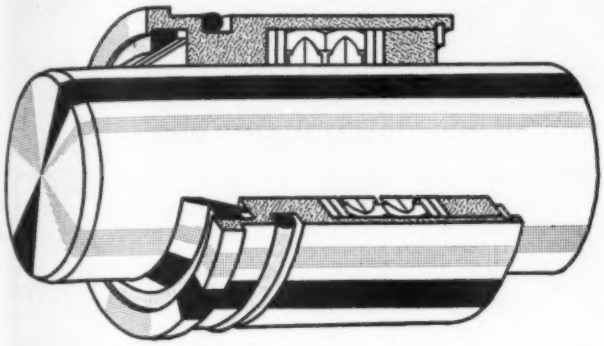
where over-riding manual operation is called for.

Size: This particular cylinder has a 6 in. bore with a 4 in. stroke and is capable of exerting a

Circle 31 on Reader Service Card

MONOPAK-CARTRIDGE PACKING UNIT!

For Pneumatic and Hydraulic Cylinders



Combines all necessary Packings, Bearings and Rod Wipers into One Compact Unit.

Can be installed or replaced by totally inexperienced mechanics within a few seconds.

Write for Literature

HYDRAULIC ACCESSORIES CO.
439 E. Fort St. • Detroit 26, Mich.

Up to 5 times faster response with

NEW CONOFLOW PNEUMATIC CYLINDER MOTORS

for

THROTTLING CONTROL

The New B-50 Series of pneumatic cylinders for throttling control service operate on air pressures up to 100 psig and are capable of repositioning accuracies of 1/500 part of total stem travel. Simplified one-piece piston construction features graphite impregnated "O" ring seals and a piston positioner integrally mounted in the head plate. Extra sensitive, speedy and stable—because of minimum friction and precisioned aluminum design.

Many applications include positioning electrical components, variable speed drives, rubber pinch valves, etc. Available in 4", 6" and 8" diameters with 3" and 4" stem travels. Furnished complete with cushion-loading regulator and gauge, fully piped, ready for installation.

Write for bulletin B-50-AH.

CONOFLOW CORPORATION
2100 Arch St., Phila. 3, Pa.

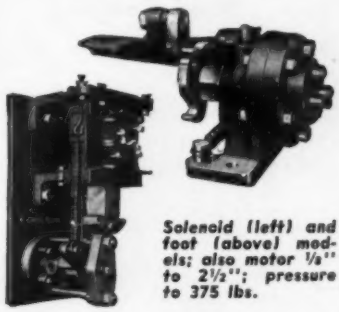
Circle 11 on Reader Service Card

Circle 45 on Reader Service Card

Leading Processor's Tests Prove

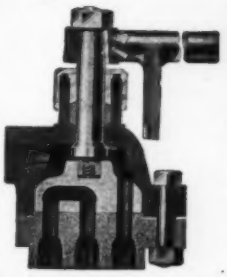
Nicholson Valves Improve With Use

Nicholson control valves were recently adopted as standard by a well-known rubber company, after years of trying practically all makes. Their capacity for longer leak-free service is confirmed by many installation records which show Nicholson valves actually become tighter with use. This is because their non-corrosive flat discs tend to lap themselves on the seats. For all mediums and types of operation.



Solenoid (left) and foot (above) models; also motor 1/8" to 2½"; pressure to 375 lbs.

Lever models (below), ¼" to 2½"; pressure to 5000 lbs.



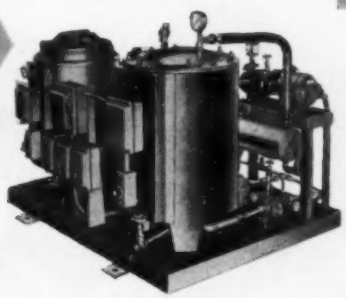
CATALOG 1250

213 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.
TRAPS · VALVES · FLOATS

Restores used hydraulic oil to like-new condition

HOFFMAN OIL CONDITIONER



Removes soluble and insoluble impurities
Capacities from 25 to 600 g.p.h.

Protects your hydraulic equipment—lengthens oil life without high maintenance cost of centrifuges. The Hoffman Oil Conditioner consists of a cartridge filter and vaporizer, mounted on a common base, portable if desired. Complete with all necessary electric and pump connections. Only two moving parts—no steam or water connections. Write for technical bulletins.

FILTRATION DIVISION
U.S. HOFFMAN MACHINERY CORPORATION
218 LAMSON STREET, SYRACUSE 6, N. Y.
CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

Circle 74 on Reader Service Card

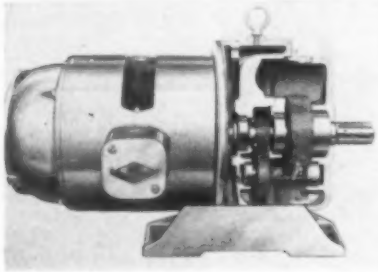
thrust of approximately one ton when supplied with air at 80 psi.
Feature: The mechanical operation is by a hand wheel (not illustrated) which is fitted to the end of the cylinder opposite to the piston rod.

Circle 161 on Reader Service Card

Gear Reducer with Fluid Coupling

Reuland Electric Co., Alhambra, California

Size: Wide range of power ratings with output speeds of 1 to 600 rpm.



Service: Converts the motor's conventional high-speed into slow-speed, high torque output. Ideal for cranes, conveyors and other machinery where heavy loads require smooth acceleration at reduced motor speeds.
Design: Consists of a standard Reuland fluid shaft motor and gear train, designed into a single, compact unit. An integral fluid coupling provides cushioned starting of heavy loads and protection against "jamming" of equipment.

Circle 162 on Reader Service Card

Hose Assembly Machines

A. Schrader's Son Division of Scovill Manufacturing Company, Incorporated, Brooklyn, N. Y.

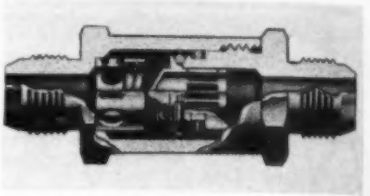
Designation: Ferrule Contracting Machine 1765
Service: For producing quantities of uniform, fitted hose lengths.
Design: Air cylinder power is adapted to a die type contracting machine. Interchangeable dies enable the machine to be set up quickly for various size ferrules. Foot pedal operation permits the use of both hands to feed and remove the work. Easily hooked up to any shop air line.

Circle 163 on Reader Service Card

High Pressure Air Valve

James-Pond-Clark, Pasadena, California

Designation: Circle Seal Check Valve, 299A-4TT



Service: For high pressure air or nitrogen from 0 to 3000 psi; proof pressure 6000 psi; operating temperature, -65 to 165 F; flow check leakage none; mounting limitations, none.
Design: Utilizes the "Circle Seal" principle which provides dead tight sealing not only at high pressures, but also at very low pressure differentials.

Circle 164 on Reader Service Card

PEMACO HYDRAULIC AND AIR CYLINDERS
with the NEW
Cartridge Type Packing Gland

Designed to J. I. C. Hydraulic Standards

Pemaco Hydraulic Cylinders are soundly engineered—give long life and top performance. The steel ram is hardened to 50.C Rockwell, ground and lapped. NOW the Pemaco has the first self-contained Cartridge Type Packing Gland.

This new Pemaco "EASY-PAK" Gland is designed to comply with J.I.C. Standards. It combines double bearing surface, low friction ram seal, and a ram wiper into a single compact unit. Easily maintained, the Pemaco "EASY-PAK" Cartridge Type Packing Gland can quickly be replaced in most cases without removing the cylinder from the machine — and by inexperienced help — greatly reducing machine down-time.

Pemaco "EASY-PAK" Cartridge Type Packing Glands are manufactured for both hydraulic and air cylinders.

PETCH MANUFACTURING COMPANY

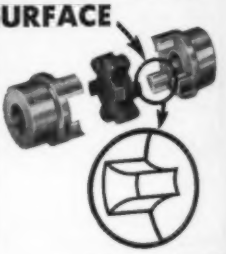
Write for complete information and engineering data.

36100 HARPER AVE.
MT. CLEMENS, MICH

Circle 52 on Reader Service Card

NOT JUST ANOTHER COUPLING

GERBING'S *Exclusive* CONCAVE JAW SURFACE



The concave jaw surface of the new Gerbing Flexible Coupling actually holds the resilient synthetic rubber insert or spider in position, thus eliminating any tendency of the rubber to break or extrude. Capable of handling peak loads, shocks and overloads. Instantly compensates for angular and parallel misalignment.

Available for shafts ½" to 1⅞" and H.P. ranges from fractional to 25. Standard keyways are provided. A long-lasting vibration-free drive for a wide range of applications. Deliveries from stock.

Write for details

. . . holds spider in position at all times —No extruding!

- NO BREAKING OF SPIDER
- CLOSE CONCENTRICITIES ASSURE VIBRATION-FREE OPERATION

GERBING MANUFACTURING CORP.

NORTHBROOK, ILL. (Suburb of Chicago) Dept. B-C

Circle 22 on Reader Service Card

Circle 60 on Reader Service Card

TINY but MIGHTY!

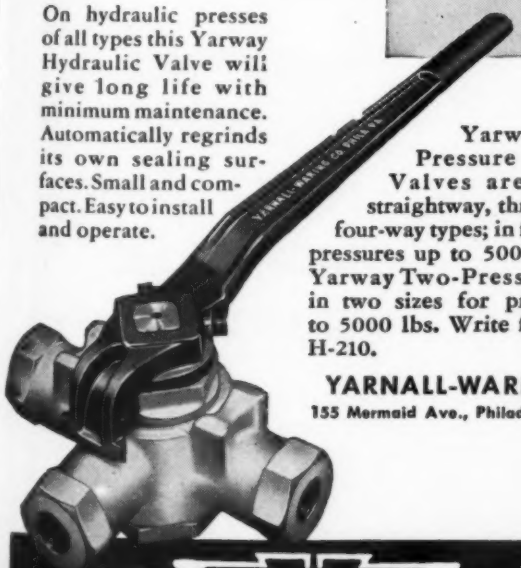
SKINNER STAINLESS STEEL SOLENOID VALVES

...Another case of "a good thing in a small package"! Users are amazed at the ruggedness and unusually large capacity of Skinner Valves—they're tiny but mighty, with a standard range for gaseous or liquid media from 5 to 250 p.s.i., and special from 5 to 850 p.s.i. Their soft insert seat prevents leakage and positive action is assured by spring loading. Skinner Valves may be used in any position, with pipe connections furnished to suit specifications. Power consumption is 10 watts max. Special coils for high humidity or high temperature applications can be supplied. Standard models are approved by Underwriters' Laboratories. *Write for Bulletin No. 501.*

SKINNER ELECTRIC VALVE DIV.
THE SKINNER CHUCK COMPANY
142 Belden Ave., Norwalk, Conn.

The Higher the Pressure ...the Tighter the Valve

On hydraulic presses of all types this Yarway Hydraulic Valve will give long life with minimum maintenance. Automatically regrinds its own sealing surfaces. Small and compact. Easy to install and operate.



Yarway Single-Pressure Hydraulic Valves are made in straightway, three-way and four-way types; in five sizes for pressures up to 5000 lbs. Also Yarway Two-Pressure Valves in two sizes for pressures up to 5000 lbs. Write for Bulletin H-210.

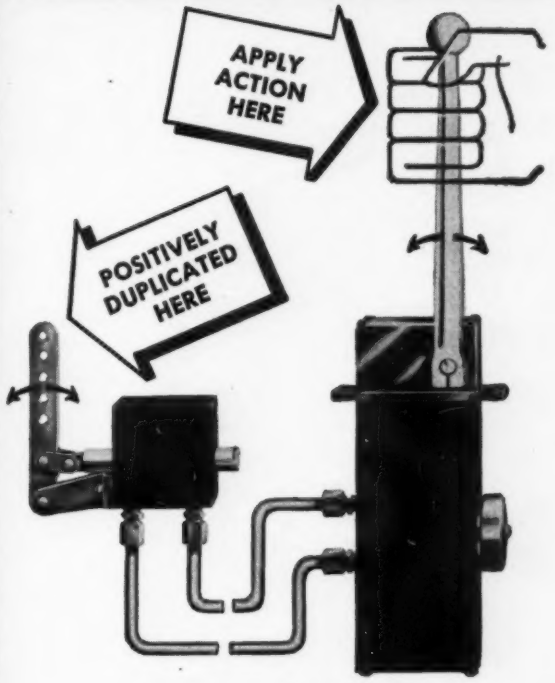
YARNALL-WARING CO.
155 Mermaid Ave., Philadelphia 18, Pa.

YARWAY
Improved Type
HYDRAULIC VALVE

Circle 82 on Reader Service Card

SUPERDRAULIC

PUMPS • VALVES • TRANSMISSIONS • TEST STANDS • REMOTE CONTROLS



POSITIVE REMOTE CONTROL

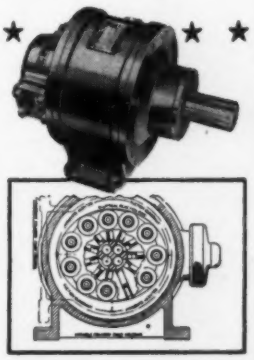
A simplified device for positioning, controlling and duplicating movement at a distance. Automatically compensates for contraction and expansion of fluid media. Operates with a smooth, rigid, silent and sensitive stroke. Many superior engineering features.

APPLICATIONS INCLUDE: processing machinery, assembly fixtures, air and marine craft, earth moving, farm, railroad and construction equipment, machine tools, test cells and military vehicles. Write for catalog.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

FAMOUS SUPERDRAULIC HIGH PRESSURE PUMP

Develops up to 60 H.P. at 5,000 P.S.I. Let us quote on your requirements.



Superdraulic
CORPORATION
14256 WYOMING AVE. • DETROIT 4, MICH.

Circle 64 on Reader Service Card

Air Valve

Mechanical Air Controls, Royal Oak, Michigan

Designation: "MAC" ¼" #501 4-way solenoid operated air valve.

Service: For actuating double acting cylinders. Current requirements of the solenoid are .8 amps inrush and .2 amps holding at 115 volts, 60 cycle. They are available for any voltage or cycle requirement and can be mounted in any position.

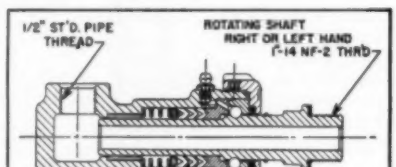
Design: This valve has a full ¼ in. pipe orifice area through the valve, and operation is by direct solenoid control and spring return of an aluminum spool which is the only moving part in the unit. Special "O" rings mounted on this spool act as seals when they come in contact with the bores of the body and end cap retainers. Parts consist of a cast iron base, bronze body and retainers, aluminum spool and solenoid with aluminum cover.

Circle 165 on Reader Service Card

Revolving Joint

Barco Manufacturing Co., Chicago, Illinois

Service: For making air or hydraulic line connections to high speed rotating clutches, chucks and similar equipment. It is suitable for use at temperatures as high as 425 F and speeds to 1800 rpm or more, under certain conditions.



BARCO TYPE 1BRSA ASSEMBLY

Design: The joint features new type chemically inert "V" seal rings which have a low friction coefficient, little affected by increase in pressure and free from scoring tendencies.

Application: Connection to rotating machine or part is made by screwing the male threaded steel shaft of the joint into the hub of the chuck or clutch. Use of hose is recommended to make a free floating installation.

Circle 166 on Reader Service Card

"O" Ring Compound

The Parker Appliance Company, Cleveland, Ohio

Designation: Compound 90.
Properties: Has tensile strength of 1450 psi with no loss of strength after aging 7 days in either air or AXS 808 oil at 158 degrees F. Elongation is 210, with a 150 value after aging. Hardness is Shore 90, unaffected by aging, Volume swell in the 7 day hot oil test is only 4.6 percent. Properties exceed the re-

Let The ARIDIFIER

CLEAN YOUR AIR AND GAS LINES

Removes 92% Oil, Water and Dirt

The Aridifier gives you positive removal of oil, moisture and other foreign matter from air or gas lines. With paints and lacquers it often eliminates bloom and imperfections in finish. It provides dry lines for ceramics, sand blasting, for air cleaning, etc. Wherever the need exists for dry clean air or gas, the Aridifier delivers the goods. Easily installed. No maintenance problem. 10 models available. Capacity range: As low as 7 CFM to 17,000 CFM.

BULLETIN 147 Tells The Complete Story

HOW IT WORKS Exploded view shows how four multi blade rotors revolve at high speed in opposite directions under impact of air movement through non-aligned rotor spaces. Moisture, dirt and other foreign matter which collect on rotor blades are thrown out of air stream by centrifugal force to side of housing, and pass into drain.

Made By The Manufacturers of Logan Lathes and Shapers.

Logan ENGINEERING CO.

4920 W. LAWRENCE AVE., CHICAGO 30, ILL.

Circle 37 on Reader Service Card

"SEAL-GUARD" METALLIC ROD WIPER

PROTECTS YOUR CYLINDER RODS, MACHINE SPINDLES, GUIDE PINS AND LOCATING PINS

The "Seal-Guard" Metallic Rod Wiper affords permanent protection from falling or flying debris . . . Two flexible bronze rings mounted in synthetic rubber lift off harmful substances completely by means of their knife-edged conical surfaces . . . The device is self-adjusting through action of rubber on staggered scraper rings . . . Rod diameter sizes are from ½ to 10 inches.

Write for Literature

HYDRAULIC ACCESSORIES CO.
439 E. Fort St. · Detroit 26, Mich.

Circle 85 on Reader Service Card

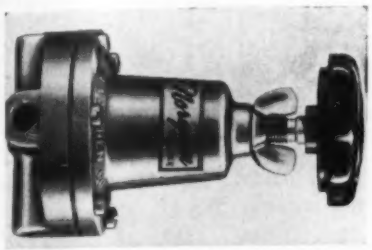
quirements of Army Ordnance Specification AXS 1440, Class "A".

Circle 167 on Reader Service Card

Air Pressure Regulator

C. A. Norgren Co., Englewood, Colorado

Service: For precision control at low flow of air and gases.



Design: Operates on primary line pressures up to 400 psi with delivery pressures ranging from 0 to 30 psi. The regulator has a built-in relieving feature which prevents a build-up of excessive pressures. Unit provides exact pressure control at flows from 9 to 2 cfm.

Circle 168 on Reader Service Card

Compressed Air Filter

Hankison Corporation, Pittsburgh, Pennsylvania

Designation: Model B Condensi-filter

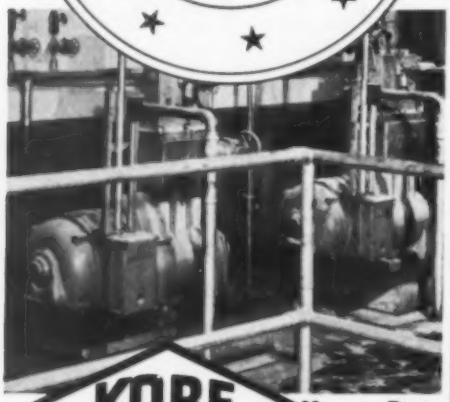
Service: For removing water, oil, sludge and other foreign materials from compressed air used to operate instruments and machines.

Design: Combines a dehydrating device, a mechanical filter and a self-purging trap. Measuring only 15 in. high and 9 in. in dia. it has a capacity of 30 cfm at 100 psi.

Circle 169 on Reader Service Card

The Electrol
SPEED CONTROL VALVE
ELECTROL
540
Handles Air...Oil or Water with
Operating Pressures Up to 1,500 P.S.I.
The Electrol Speed Control Valve is designed to handle air . . . oil or water with operating pressures up to 1,500 P.S.I. It allows free flow in one direction and — by use of a metering device and check valve — accurately controls reverse flow from 0 to valve maximum, even after thousands of cycles. It is available with ⅛", ¼", ⅜", ½" and ¾" NPT ports. Write for details. Your inquiry will receive prompt attention.
Electrol
INCORPORATED
HYDRAULICS
KINGSTON, NEW YORK
Better Designed Products Use Electrol Hydraulics
CYLINDERS • SELECTOR VALVES • FOLLOW-UP VALVES
CHECK VALVES • RELIEF VALVES • HAND PUMPS
POWERPAKS • LANDING GEAR OLEOS • SOLENOID
VALVES • ON-OFF VALVES • SERVO CYLINDERS • TRANSFER
VALVES • CUT-OUT VALVES • SPEED CONTROL VALVES

Circle 19 on Reader Service Card



KOBE Heavy Duty High Pressure

Triplex Pumps

Case History A 5: In June, 1948, 2 Kobe Triplexes were installed in the California Plant of the Ohio Rubber Company, makers of automotive molded and extruded rubber products. The specified requirement was to operate 7 hydraulic molding presses 24 hours a day, 6 days a week, at pressures of 2,000 psi.

"Extremely Satisfactory Service"

Mr. L. Kotich, Chief Engineer for the company states, "These pumps have given extremely satisfactory service—even when called upon, as they sometimes are, to operate for as long as 3 weeks continuously."

Again the Kobe Triplex proves its right to be called the most dependable source of high pressure hydraulic power available.

Features:

- Pressures—To 5,000 psi (standard) To 20,000 psi (special)
- Volumes—To 60 g.p.m.
- Power Ratings—15, 30, and 50 H.P.
- Integral Double Reduction Gears
- Integral Electric Drive (optional)
- Easily interchanged Plungers and Liners
- Built-in Pressure Lubrication
- Easily Accessible Ball Type Check Valves

Write for Bulletin

KOBE INC., Division of Dresser Equipment Co., 615 NBC Bldg., 815 Superior Ave., N.E. Cleveland 14, Ohio

KOBE INC.
Division of Dresser Equipment Co.
Plant: Huntington Park, Calif. — Representatives in CLEVELAND, Pittsburgh, New York, Houston, Oklahoma City.

Circle 32 on Reader Service Card

Explosion-Proof Air Control Valve

The Bellows Co., Akron, Ohio

Designation: Electroaire Explosion-Proof Valve.

Service: Electrically controlled four-way directional air valve which meets Group D, Class 1, Standards for wiring in hazardous locations.

Sizes: Available in ¼, ⅜, and ½ in. pipe sizes.

Design: Tiny, sealed, 8 volt solenoids serve as triggers to release the pressure of the incoming high pressure air against either side of a floating piston which operates the slide valve. The plungers of these tiny solenoid control units move only 1/32 in. The solenoids will operate continuously at speeds up to as high as 2,200 movements a minute without hum, pounding or overheating. They are guaranteed against burnout.

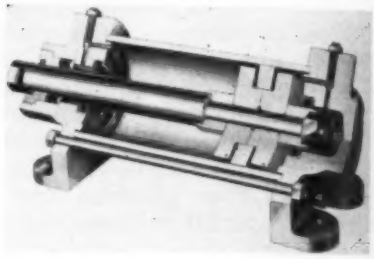
Circle 170 on Reader Service Card

Flexible Cushion Sealing

The Tomkins-Johnson Co., Jackson, Michigan

Designation: "Super Cushion" air cylinders.

Application: For air power jobs requiring a linearly applied force.



They're BIG...
in size and performance

Regardless of size, bore, stroke and pressure requirements, COLUMBIANA ENGINEERING is completely equipped to design and build hydraulic and air equipment to meet your specifications.

- Hydraulic and Air Cylinders
- Hydraulic Power Units
- Accumulators and Intensifiers
- Hydraulic Presses
- Forging Manipulators
- Charging Machines
- Special Hydraulic Machinery *Catalog Available*

Get prompt practical help on your needs by writing today to:

COLUMBIANA ENGINEERING COMPANY

115 East Salem Street—Columbiana, Ohio

Circle 9 on Reader Service Card

Design: A flexible cushion seal is built into the cylinder end caps. This positive cushion is combined with automatic valving action for fast return stroke. The flexible cushion eliminates possible binding and sticking encountered in other methods where close fits are required to effect a seal. Metal rod wiper ring affords permanent protection from dirt and grit. Two flexible bronze rings mounted in synthetic rubber wipe off harmful substances completely by means of knife-edged conical surfaces.

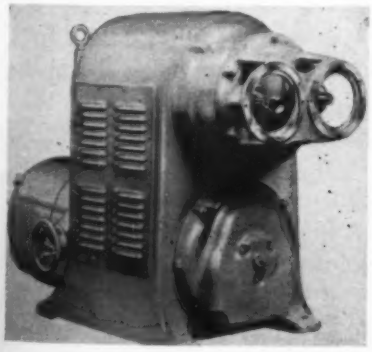
Circle 171 on Reader Service Card

Dual Head Aero Test Stand

U. S. Electrical Motors Inc., Los Angeles, California

Service: To determine the operating characteristics of component parts such as aircraft generators, vacuum pumps, alternators, magnetos, hydraulic pumps and compressors. The dual head permits a wider variation than a single head in take-off speeds. It permits two component parts to be tested at one time.

Design: Consists of a variable



speed motor which can be instantly changed from speed to speed by merely turning a control dial. Brackets are mounted on the motor to accommodate various components to be tested.

Sizes: The horsepower for continuous duty is from 7½ to 50, and for intermittent duty from 10 to 75 hp. Speeds and ratios may be changed to meet the user's particular requirements.

Circle 172 on Reader Service Card

TROSTEL QUALITY

Engineered for your specific sealing requirements

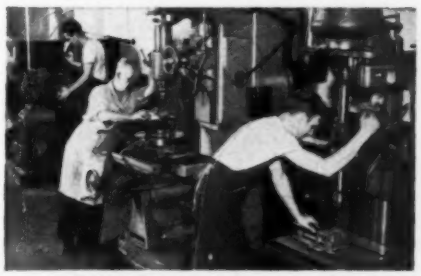
There are no "standard" packings or oil seals in the complete Trostel line—only standard sizes. The seal itself . . . in leather or synthetic rubber . . . is individually developed for the requirements of each specific application . . . by one or more of three separate and distinct Trostel laboratories.

Working closely with the laboratories, the Trostel tool room designs and builds the tools which make it possible to retain *in production* the special properties and tolerances originated by the laboratories and pilot plant.

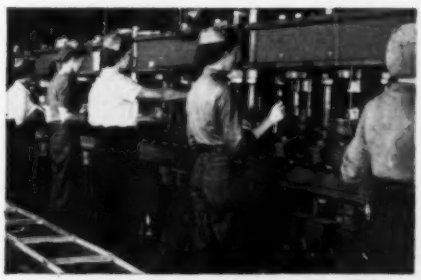
Modern production machinery... specially designed to permit *full automatic control* of critical time, pressure, and temperature cycles . . . provides further assurance of consistent quality.

We invite your inquiry.

LABORATORY CONTROL



COMPLETE TOOLING FACILITIES



MODERN PRODUCTION MACHINERY

ALBERT TROSTEL & SONS COMPANY
General Offices and Packings Division • Milwaukee 1, Wis.
Sales Offices: Houston • Los Angeles • Worcester, Mass. • San Francisco • Seattle

Circle 70 on Reader Service Card

Useful Catalogs and Bulletins

available for reference

Hydraulic Cylinders For 5000 psi Operation . . . Munton Manufacturing Co. offers a series of catalog sheets giving construction and dimensional data on their 5000 psi series high pressure hydraulic cylinders. Piston uses cast rings with felt wipers at both ends to wipe the honed cylinder wall. These tie-rod constructed cylinders have steel caps and domes.

Circle 210 on Reader Service Card

Cartridge Packing . . . Hydraulic Accessories Co. has issued an 8-page folder describing the design and use of their Monopak cartridge. A selection chart lists the features for each of the six available models. There are two series, one for 0 to 500 psi operation and the second for 0 to 1500 psi. Complete dimensional drawings are included.

Circle 211 on Reader Service Card

Solenoid Valves . . . Waterman Engineering Company has issued a new illustrated booklet on their products. It describes with photos and diagrams several new and improved high pressure solenoid valves, showing their construction and their typical application. They are especially suitable for all hydraulic systems handling non-corrosive fluids.

Circle 212 on Reader Service Card

Leather Packings . . . Informative data folder on Tannate Leather Packings offering service, maintenance and storage hints along with drawings of leather packings suitable for hydraulic and pneumatic equipment. Complete specifications are included in this J. E. Rhoads & Sons data folder.

Circle 213 on Reader Service Card

Rotary Screw Pump . . . Bulletin L313B describes the new DeLaval A313B IMO rotary pump. Its applications and uses include hydraulic applications which require pressures to 275 psi continuous and to 325 psi intermittent. Nine pump sizes are charted from 2.2 gpm to 79.4 gpm. The bulletin contains a cut-away section of the pump, complete description, viscosity tables and dimensions for various frame sizes. The main features of the pump include: pulsation free flow, mechanical shaft seals, pre-lubricated bearings, and optional types of mountings. It can be mounted in any position and be driven by direct connected shaft, V-belts, or chains.

Circle 214 on Reader Service Card

Hydraulic Self Sealing Quick Couplers . . . A coupler, guaranteed at burst pressure of 30,000 psi, is described in a folder offered by Pioneer Pump Mfg. Company. A cutaway view clearly shows the construction features which assure maximum free fluid flow. The coupler features newly developed "O" ring groove and perfectly centered steel ball checks. The coupler will swivel and will recouple, without the loss of any oil, at low pressures. Dimensional data is included.

Circle 215 on Reader Service Card

Air Idea File . . . Ten data sheets ready-punched to fit in your idea file are available from the Westinghouse Air Brake Company. Each sheet gives a typical air powered installation diagram along with complete details concerning the components and application. Applications include special presses, assembly fixtures, feeding and winding devices.

Circle 216 on Reader Service Card

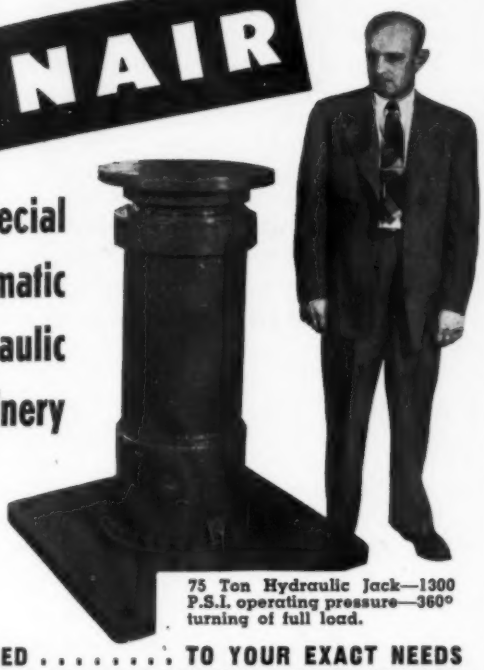
Air Filter . . . Operation of Logan Engineering Company's Aridifier is described in Bulletin sheet 1150. Size selection data is provided along with installation data. An exploded view shows how the air is "laundered" and dried as it passes through the filter. The force of the compressed air in passage through the filter revolves four multi-bladed rotors at high speed in opposite directions. Moisture and contaminating matter are thrown by centrifugal force to the outside wall and flows by gravity into a trap.

Circle 217 on Reader Service Card

Circle 40 on Reader Service Card

LYNAIR

Special Pneumatic or Hydraulic Machinery



75 Ton Hydraulic Jack—1300 P.S.I. operating pressure—360° turning of full load.

JOB DESIGNED . . . . . TO YOUR EXACT NEEDS
BUILT . . . TO GIVE OUTSTANDING PERFORMANCE

Whenever you need dependable highly efficient pneumatic or hydraulic machinery custom made to meet your specific requirements get in touch with Lynair. Get prompt practical service.

Write today for complete details.

- Standard Jackson Air Cylinders
- Special Cylinder Designers

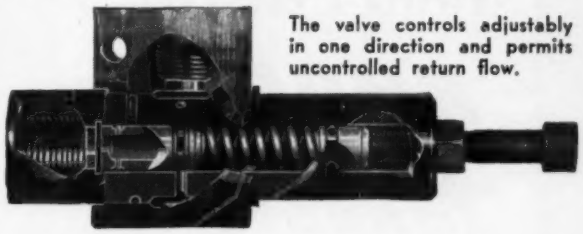
New Catalog AH-52 now available

LYNAIR, INC., Jackson, Michigan

Circle 78 on Reader Service Card

An adjustable FLOW REGULATOR

This newly perfected adjustable Flow Regulator holds at a constant rate even though the pressure fluctuates.



The valve controls adjustably in one direction and permits uncontrolled return flow.

The spring back piston in the housing is mounted in front of the adjustable screw. It carries a calibrated orifice; operates axially on change in inlet pressure so as to increase the throttling action.

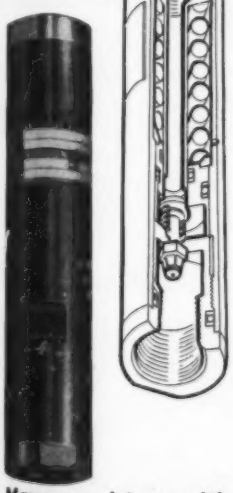
Four sizes, 1/4, 3/8, 1/2, and 3/4 inch. Overall length, 4 1/2 to 7 1/2 inches. Adjustable over a 50% flow range. Maximum pressure is 3000 pounds.

Write for illustrated circular.

West Coast: H. E. Webb
918 North Kenilworth Avenue Glendale, California

WATERMAN ENGINEERING *Company*
725 CUSTER AVENUE • EVANSTON, ILLINOIS

NEW! balanced outlet RELIEF VALVE



For pressures to 3000 psi

The new exclusive Vinson design is completely balanced and indifferent to pressure changes or surges down stream. Its operation is silent and smooth with no chatter, no squeal, no screech. Manufactured in four sizes 1/4", 3/8", 1/2" and 3/4", the valve is offered in three configurations.

1. Standard unit with reverse flow checked.
2. Free flow in reverse direction.
3. Twin relief valve which relieves in both directions. Included in its applications are relief, sequence and surge damping.

May we assist you with your valve requirements. Write or wire today for prompt service.

VINSON MANUFACTURING CO.
8044 WOODLEY AVE. • VAN NUYS, CALIF.

Circle 77 on Reader Service Card

Depend On

DARCOID PRECISION

SEALS *for Guaranteed Performance!*

PRECISION SEALING is a "must" to engineers and designers in today's era of highly specialized mechanisms and equipment.

No problem is too difficult for us to tackle. Consult our Engineering and Service Departments with your specifications for DIAPHRAGMS and other PRECISION-MOLDED RUBBER PARTS.

COMPLETE O-RING STOCKS of Dash Numbers 6227, 6230 and 6290 series to meet specifications MIL-P-5516 and MIL-G-5510 available for your immediate and long range requirements.

The DARCOID Company
INCORPORATED

Authorized Distributor for The Goshen Rubber Company on all Specification Molded Parts

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Circle 13 on Reader Service Card

Good Packings

RHOADS

Tannate®

LEATHER PACKINGS

Whatever the medium used, whether it is water, vegetable, mineral, fish and animal oils, alcohol, air oxygen . . . or glycerin, gasoline, kerosene or any other non-caustic, non-acid fluid, Rhoads Tannate Leather Packings seal better and last longer. That's because they're "job-engineered" to individual applications. High temperatures and pressures have no ill effects on Tannate Packings, neither do they score or abrade . . . and their low coefficient of friction assures maximum operating efficiency and endurance.

Write for Tannate Leather Packings Data File to J. E. Rhoads & Sons, 35 N. Sixth St., Philadelphia 6, Pa.

Tannate®

CUP PACKINGS **U PACKINGS**

VEE PACKINGS **FLANGE PACKINGS**

HYDRAULIC DISCS AND WASHERS

250 J. E. **RHOADS** & SONS

PHILADELPHIA • NEW YORK

CHICAGO • ATLANTA

YEARS PRODUCING FINE LEATHERS

Circle 56 on Reader Service Card

New Line of Air Valves . . . Hannifin Corporation has prepared literature describing their new line of Pilot-Master air valves. This line offers 2, 3 and 4 way valves. The catalog illustrates solenoid, mechanical and manually operated models. A rugged piston operated poppet is the only moving part of the valve. It is assembled in a removable brass cartridge which serves both as the cylinder for the piston and as the upper seat for the poppet. This exclusive feature makes it possible to renew the valve without disturbing its main piping.

Cicle 218 on Reader Service Card

Hydraulic Accumulators . . . Catalog 115 describes the complete line of cylindrical and spherical accumulators made by Bendix-Pacific. The catalog is complete with cutaway drawings and includes an informative text on the purpose of accumulators and their application. Typical performance curves are plotted and dimensional drawings are included.

Circle 219 on Reader Service Card

Solenoids . . . Want to know more about the construction of solenoids for the operation of hydraulic and pneumatic valves? The National Acme Company offers a well illustrated Bulletin, EM 46A, which presents construction details, and pictures a variety of rugged applications. Solenoid design, materials, construction and recommendations for efficient operation are thoroughly discussed. Drawings give ideas for typical mountings and charts give stroke, force and current rating data for standard solenoids.

Circle 220 on Reader Service Card

Aircraft Hose Assemblies . . . Resistoflex Corporation has published a 12-page catalog to give the aircraft industry, in concise form, all essential information required for the application of Resistoflex aircraft hose, hose fittings and assemblies. This catalog introduces their newest developments in fittings, which fill a long-standing need for a complete line of forged, all aluminum elbow and flange fittings. In addition, you will find data on standard hose constructions, and on fittings manufactured under license of the Aeroquip Corporation. Charts are provided to assist in the determination of flow rates, bend radii and operating pressures.

Circle 221 on Reader Service Card

Gear Pumps . . . Two bulletins have just been released describing the new Hydreco 1500 series reversible rotation oil hydraulic gear pumps. These bulletins contain illustrations, dimensions and complete performance data on both flange and base mounted pumps in capacities of 6 to 8 gpm at 1200 rpm, 1500 psi. These bulletins are No. 123 and 124.

Circle 222 on Reader Service Card

Technical Data for Hose Assemblies . . . Folder No. 9, issued by Pyles Industries, Inc., gives information which will help you figure the correct length for a hydraulic hose assembly for stationary and relative motion installations. Information on hose construction and fitting styles and sizes are also included in this data folder.

Circle 223 on Reader Service Card

Precision Instruments . . . Advanced type slack tube manometers, magnehelic gages, Visi-Float air filter gages, hook gages and smoke gages engineered for utmost sensitivity and accuracy are high-lighted in a new catalog recently issued by F. W. Dwyer. These are new additions to the company's complete and long established line of portable and stationary gages for measuring positive or differential pressure, vacuum, velocity, flow or temperature of gases in laboratory, factory or field work.

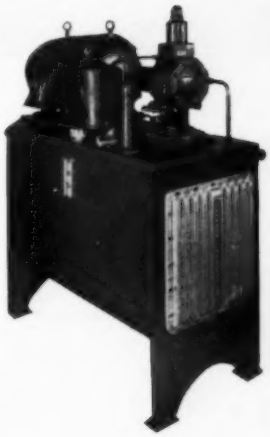
Circle 224 on Reader Service Card

Hydraulic Cone Check Valve . . . New data sheets are available on hydraulic cone check valves for both 1500 and 3000 psi service, manufactured by Parker Aircraft Co. The separate sheets contain description, illustration, dimensional tables, specifications and performance curves for AN 6207 (1500 psi-aluminum alloy) and AN 6249 (3000 psi-steel) types—both with flared tube ends—and the AN 6280, 3000 psi-steel series, which has internal straight threads.

Circle 225 on Reader Service Card

Circle 8 on Reader Service Card

NEW CENTURY RESERVOIRS



Complete line 30 to 500 gallons for semi-custom power units.

1. Three point suspension plate supports for motor and pump without distortion
2. Ample suction and drain connections
3. Inspection and cleanout covers on both ends
4. Oil level indicators and safety filter-breather caps on both sides
5. Pick up lugs on all four corners
6. Round bottom; drain plugs at both ends. Pump and motor mounted if desired; entire power units furnished.

Full conformance to JIC Hydraulic Standards

"If it's Hydraulic, Century Designs & Builds Them"

Century Hydraulics

18135 James Couzens Highway • DETROIT 35, MICHIGAN

Roylyn COUPLINGS

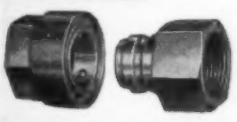
IMPORTANT FEATURES

- LIGHT WEIGHT
- QUICK CONNECTING
- POSITIVE LOCKING
- HIGH PRESSURE SEAL
- VIBRATION PROOF
- WIDE TEMPERATURE RANGE
- SIZES FROM ¼ INCH TO 6 INCH

* FOR MANY VARIED INDUSTRIAL USES:

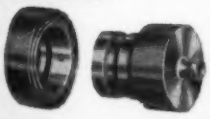
- Railroad Diesel fuel lines
- Marine fuel loading lines
- Tank and Line Pressure Tight Caps
- Processing and Chemical Industries
- Petroleum loading valves and connections
- Liquid transfer and closed hydraulic systems

OPEN COUPLINGS



SELF-SEALING COUPLINGS

CAPS & PLUGS



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Hannifin "Air Warden" safeguards against loss of production time—protects your valuable air-operated equipment three ways.

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Circle 84 on Reader Service Card

Progressive Overhaul Cuts Aircraft Maintenance Costs

By Jack Burnell
Director of Maintenance and Engineering
Frontier Airlines, Inc.

THE HYDRAULIC CREW is shown lowering landing gear (functional gear retraction test) in a scheduled work operation of pattern Number 6. Inspector is at left, lead man center and mechanic, right. The portable test stand or Jenny is at the right.

The Progressive Overhaul Plan described is a development resulting from an accumulation of ideas, modifications and suggestions by the maintenance administrative staff of Frontier Airlines.

FRONTIER Airlines, at their maintenance base at Stapleton Field, Denver, has worked out a Progressive Overhaul Plan which has increased maintenance efficiency at lower cost and resulted in greatly increased availability per plane for regular flight service. The progressive overhaul, planned and executed in six basic patterns, has, in one year's operation, reduced maintenance time per airplane 600 hours and has made

SILICONE "O" RINGS

Good News For Today's Designer

Results from a recent survey show the successful use of a variety of silicone compounds in seal applications never attempted before with a resilient material because of temperature limitations. According to Linear, Incorporated, of Philadelphia, Pa., a principal manufacturer of "O" Rings, one group of silicone compounds have been designed for general use at temperatures ranging from −65° to +500°F. Modifications of the general purpose stocks have produced several compounds with extreme low temperature flexibility. Other types possess a maximum resistance to compression set over a wide temperature range.

Chart Tells The Story

SILICONE RUBBER STOCKS

Linear Style No.	Hardness Shore A Scale	Tensile Strength Min. (P.S.I.)	Elongation Min. (%)	Temp. Range (°F.)	Compression Set*	Color
ZK-50	50	400	100	−65 to +400	10 to 20	Red
ZA-60	60	400	150	−65 to +400	50 to 70	White
ZM-70	70	500	75	−65 to +400	15 to 25	Gray
ZN-80	80	600	50	−65 to +400	20 to 35	White
ZT-60	60	350	130	−125 to +400	30 to 50	Red
ZD-60	60	350	150	−85 to +400	40 to 60	Red
ZE-45	45	550	250	−125 to +400	40 to 60	Red-Tan
ZJ-60	60	500	70	−65 to +400	20 to 30	Red
ZP-80	80	550	50	−70 to +400	60 to 80	Gray
ZS-80	80	550	50	−70 to +400	25 to 30	Gray
ZU-50	50	600	225	−65 to +400	65 to 75	Neutral

* Method B 22 hours at 300°F.

Notes:

1. *Temperature range values are based on actual experience in the field and the silicone rubber will perform very satisfactorily within these ranges over long periods of time. Intermittent temperatures as high as +500°F. are not harmful in most applications, but will shorten the ultimate life of the rubber.*
2. *All other values were determined at room temperature according to A.S.T.M. procedure. For silicones, room temperature values are retained with relatively little change over a wide temperature range. Therefore, they can be used with some assurance in selecting compounds for specific applications.*

Successful Usage Today

Silicone "O" Ring gaskets have proven to be highly successful as static sealing parts on a wide variety of equipment subject to extreme temperature conditions, oxidation, or to prolonged weathering. Silicone seals are giving outstanding service on certain types of aircraft shut-off valves which control the in-take of hot air from the intermediate stages of jet engine compressors under 500°F. operating conditions. Further investigation indicates the use of silicone "O" Rings on outdoor flood-lights, steam irons, transformers, geophysical equipment and diesel engines.

Research For Tomorrow

Linear Incorporated is continuing its Research Program to develop new silicone seals to meet the increasing demand for elastomers having a wide variety of physical properties. The future indicates that there will be expanding requirements for the many advantages offered by silicone as an outstanding engineering material for sealing purposes.

GASKET SPECIFICATIONS:

- MUST WITHSTAND TEMPERATURE VARIATIONS OF −125°F. to +400°F.
- MUST BE MOISTURE RESISTANT
- MUST WITHSTAND SEVERE THERMAL AND MECHANICAL SHOCK

LINEAR

SILICONE "O" RING GASKETS MEET TOUGH SPECIFICATIONS

LINEAR Silicone "O" Rings help the design engineer solve any number of unusual specifications. The ability to withstand extremes in temperature, for example, is typical of the high flexibility of this seal.

In this application, the need was for a gasket with a flexibility that could resist heat as high as +400°F. or cold as low as −125°F. Complete elimination of moisture, oxidation, thermal and mechanical shock to lens and bulb of the searchlight was an absolute must.

The sales potential of this product has been strengthened with LINEAR Silicone "O" Ring Gaskets. No longer do gaskets deteriorate rapidly, permitting moisture to enter socket . . . no longer do bulbs break because of thermal or mechanical shock . . . no longer is it necessary to replace gaskets whenever a bulb needs replacing. LINEAR "O" Rings keep a tight, moisture-proof seal throughout all extremes of weathering—they do not become gummy or stick at high temperatures.

To lower costs and reduce sealing maintenance, consult LINEAR for all your sealing requirements.

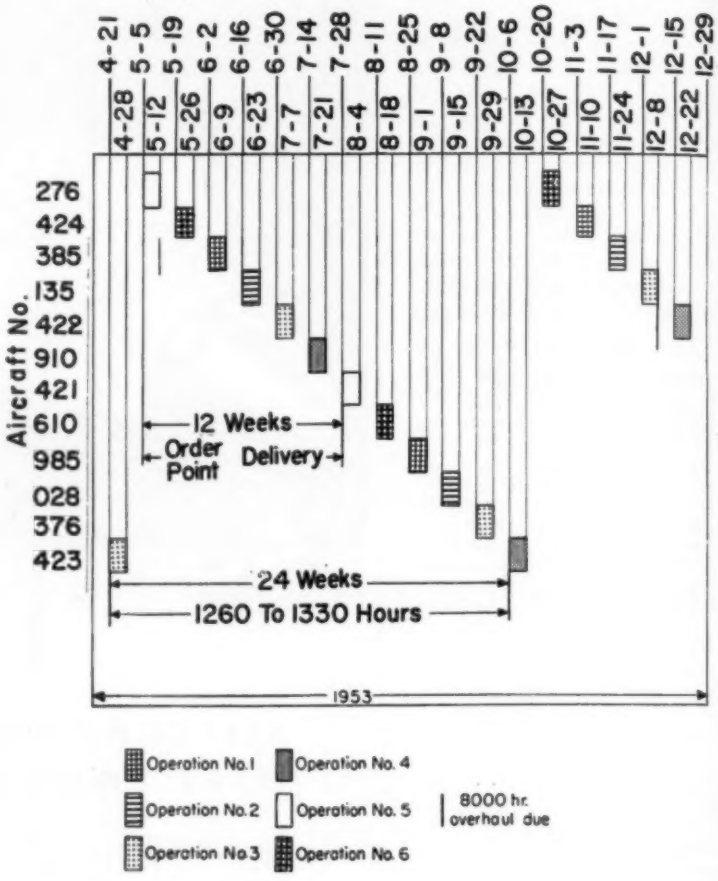
"PERFECTLY ENGINEERED PACKINGS"

LINEAR

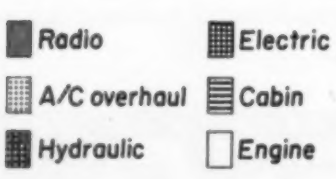
LINEAR, Inc., STATE ROAD & LEVICK STREET, PHILADELPHIA 35, PA.

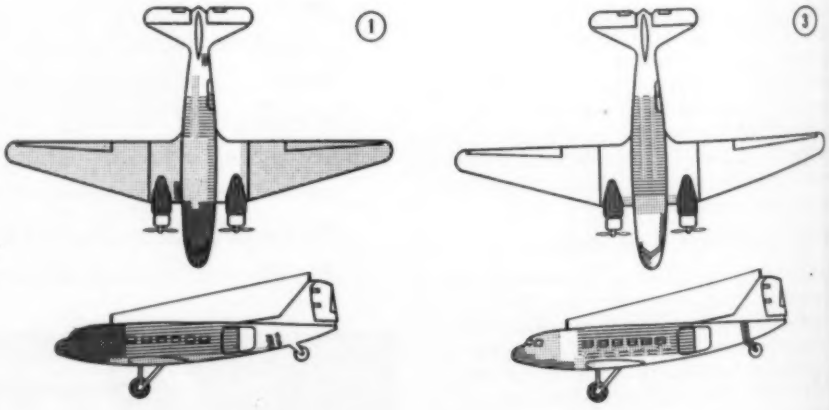
Circle 36 on Reader Service Card

THE MASTER SCHEDULE for work patterns for Frontier's DC-3's during 1952 shows the 24 week interval between patterns per plane and the alternate week plan for work on succeeding airplanes.



THE COORDINATION between work crews and identification of operations is visualized by colored zoning charts. The four charts (1, 3, 5 and 6) on which scheduled hydraulic work is done are shown.





each of the line's twelve DC-3's available an additional 48 days per year.

The progressive overhaul plan grew out of the collective planning of the engineering and maintenance and inspection personnel with the objective of maintaining the maximum flight schedules possible. Obviously, if each airplane came into the base shops for its 8000 hour overhaul on a time schedule alone, the shop work load would be irregular, necessitating either hiring large crews at uneven intervals or keeping individual planes grounded for excessive periods, often when seasonal traffic was heavy.

The Basic Plan

The basic idea of Frontier's progressive overhaul plan was to divide the major overhaul operations into six "patterns", each representing one-sixth of the major maintenance work required to keep the planes in top shape. The work unit was three days in each case, each plane scheduled for one of its pattern overhauls was brought into the overhaul dock on Monday morning and the work, with some exceptions due to unscheduled work uncovered by the general inspection, was finished by Wednesday night. The advantages, anticipated at the beginning of the operation of the plan, a high level of maintenance efficiency and a lower overhaul and routine maintenance cost, have been bourne out.

A smaller, stable and better trained force has resulted in a higher standard of work. The general inspections, which are routine at each of the six regular scheduled pattern overhauls, have disclosed additional jobs which are taken in stride. When such jobs are of a major character, additional men can be put into one or more of the work crews or an additional day may be used to finish the job.

The plan has meant that the work crews are fully prepared for each pattern; spares and convenient testing equipment are assembled for each crew. The plan was initiated in February of 1951 and reached its level out point by the first week of March 1952. At the end of this first year of operation, the man hour cost per airplane had been cut 600 man hours per plane. Even greater gains are anticipated as the full plan continues in operation. The higher level of maintenance has been attained, resulting in a lighter load on line service and better airplanes in service.

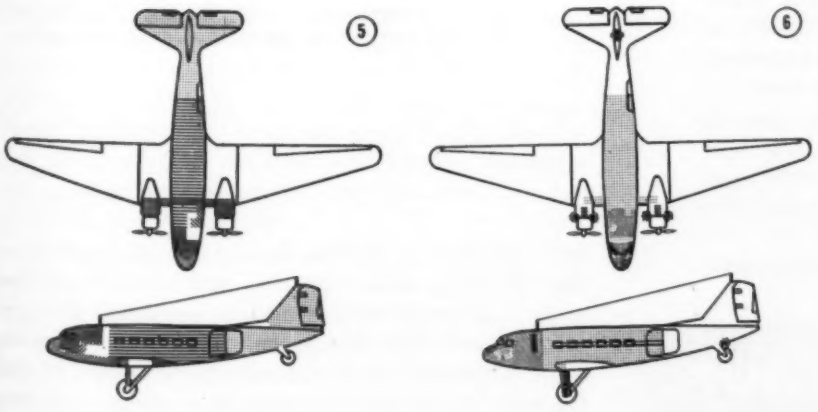
How Scheduling Works

To put the progressive overhaul plan into operation required reshuffling of aircraft inspections. Each pattern required three days. A plane comes into the overhaul dock on Monday morning for approximately 600 hours of work, which is divided into work orders for each of several crews. Personnel from the accessory shop (responsible for the hydraulic work), electric, radio, machine, sheet metal and paint and fabric shops, work through their scheduled patterns. The crews work simultaneously, the number of men at any one sector of work zone being carefully controlled to avoid crowding in confined quarters or interference with each other's sequence of operations. Each work order is done in strict sequence.

The work days when there are no planes in the overhaul dock are spent by the crews in routine shop work on the repair, rebuilding and testing of spare units removed during the overhaul operations. An essential part of this work that is essential to the plan is the assembly of parts for the next scheduled overhaul.

The general plan calls for the removal of components and units and their replacement with new or other serviceable units. This is faster than miscellaneous on-the-job repairs or adjustments and has contributed to better rebuilding work. It has also stabilized inventory and the purchasing load.

Under the master schedule any one plane arrives at the overhaul dock for one of its six scheduled overhaul patterns every 24 weeks. After the level off date (March 1952) an airplane will come into the dock for one



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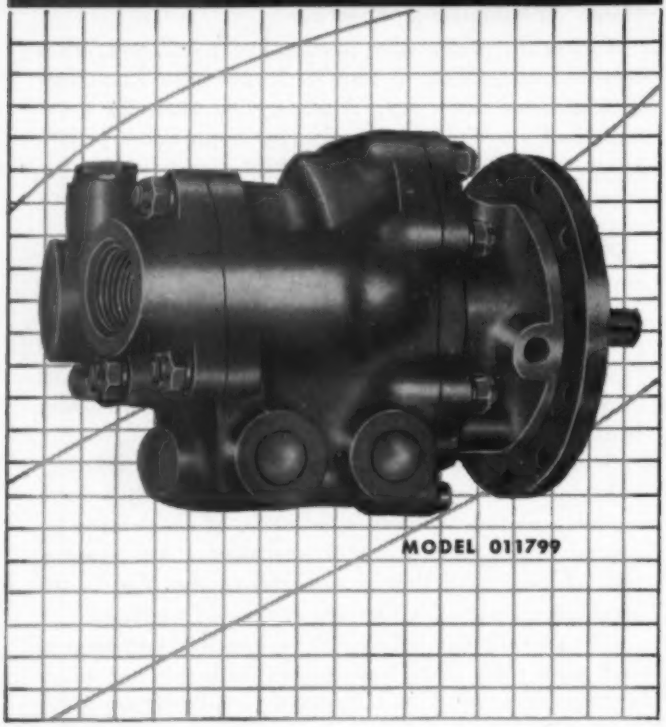
performance charts FIRST



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- **High volumetric efficiency—96% at 3000 r.p.m., 1500 p.s.i.**
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The unloading gear pump is designed to replace conventional variable volume pumps with these advantages: lighter weight, longer service life, lower maintenance expense, lower initial cost. This pump will unload up to 90% of rated flow, the remaining 10% being bypassed through a relief valve to obtain zero flow.

"Pressure Loading" provides automatic compensation for wear on the bearing and gear running surfaces and makes possible high efficiencies and long, trouble-free service life.

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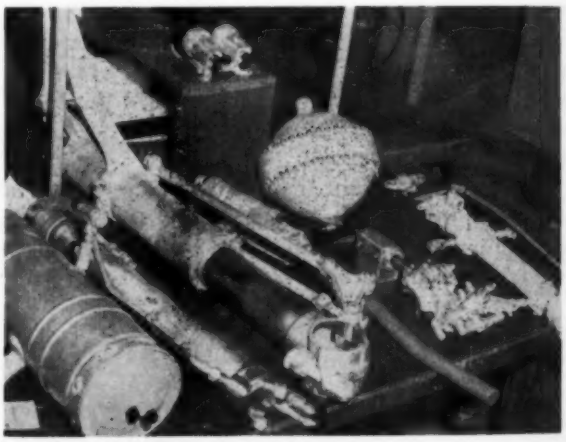
operation every two weeks. This means that only one DC-3 is off flight schedule for three days in alternate weeks. This may be changed to four days in order to balance the work load. The entire fleet will pass through a complete 8000 hour cycle each 144 weeks or 2½ years. The present plan extends through 1954.

As would be anticipated, the individual pattern costs rose for several months after the program was started in March 1951, because inspection uncovered more unscheduled work as experience was gained. For example, one airplane which came in for its first pattern overhaul seven months after the start of the program, required 1231.3 man hours to bring it up to standard. The peak coverage of 693.4 man hours per pattern was reached between May and September 1951. The man hours on the most recent pattern overhauls are running, by actual checkout, 599.5, 535.9, 554.1, 554.7 and 661.8, an average of 577.8 man hours per pattern. There is reason to believe that this average will be improved considerably during 1952.

Work Patterns

The actual overhaul work is divided into six groups: (1) hydraulic; (2) electric; (3) radio; (4) engine; (5) cabin and; (6) aircraft overhaul. The entire 8000 hour overhaul is divided through the six patterns so that all items are overhauled within their specified periods. Airworthiness directives are handled in the same manner. The starting and stopping points of the work within the operations are clearly defined so that no work is omitted. A zoning arrangement has been devised and charted so that the areas being worked on and the type of work performed are readily available for work planning.



A GROUP OF OVERHAULED hydraulic units, left to right—reservoir, landing gear, retract strut, landing gear, shock absorber strut, hand pump, accumulator, cowl flap actuating cylinder and (on box at rear) dual cowl flap valve.

The hydraulic operations on the airplane were originally done by the accessory shop, but are now being done by the Aircraft overhaul crew. The accessory shop still overhauls the hydraulic units and returns them to stock as serviceable units for use on pattern overhauls. Separate lists of operations, each arranged in a specific sequence, are provided for each work group. Not all types of operations are performed in each pattern; each pattern has its own makeup of operations.

Pattern number one may be taken as an illustration. A preliminary cleaning and preparation of the airplane before and after it enters the overhaul dock precedes the actual scheduled operations. In pattern number one there are work functions for the mechanics trained in hydraulics, electrical, general aircraft overhaul and paint and fabric work.

There is no hydraulic work scheduled in patterns number 2 and 4. The regular number 3 check is made of hydraulic lines in pattern number two and lines are repaired or replaced as necessary.

Routing of Hydraulic Components

The progressive overhaul plan requires that practically all hydraulic components be removed and replaced by either a new or another unit restored to serviceable condition. This means that practically all hydraulic components are removed to stock. The regular routing follows the following steps: (1) removal in the overhaul dock; (2) identification tagged; (3) moved to overhaul component rack; (4) rack to shop; (5) part repaired, rebuilt or discarded; (6) tag record completed and record entered on overhaul record and sent to Log and Records Department; (7) part to stock for next pattern.

Work Breakdown of Pattern

The operations for each pattern are broken down into work orders for each shop crew. Each individual job on each work order is numbered consecutively and each job is done strictly in turn. The coordination of work orders to facilitate accessibility to work zones by more than one crew follows the original plan quite closely but allows for some flexibility. Unscheduled work, whenever it occurs, is taken care of by supplementary work orders.

Frontier operates in the Rocky Mountain states with short flights from field to field. The DC-3's are modified to carry relatively bulky cargo and 24 passengers. Flying conditions are frequently rugged. The progressive overhaul plan, now in 100 percent operation, bids to lower the already favorable maintenance cost of $.1795 per revenue mile.

As the progressive overhaul plan progresses, an overall production control system is being worked out. This will eliminate the pattern work sheets and incorporate a card system. It is expected that this system will be more flexible, level out the work load more equitably, control sequence of work and inspection more easily, reduce supervision and permit more accurate cost analysis, the result of which should be increased efficiency and still lower overhaul cost.

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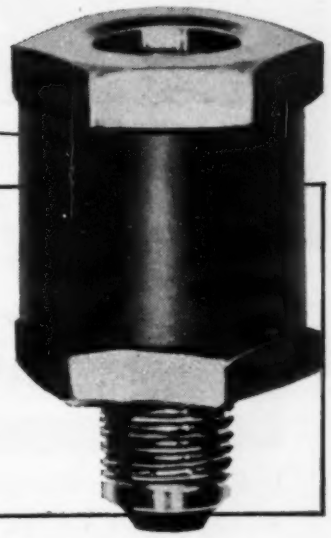

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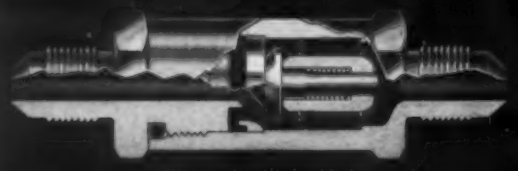

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Working Pressure 3000 PSI.

Proof Pressure 4500 PSI.

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Ports per AND10056 for ¼" tube. Other sizes and ports per AND10050 available.

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Performance features such as leakage zero—"straight through," uninterrupted airflow—dependable service under icing conditions make the Cornelius Air Check Valve an outstanding unit designed specifically for pneumatic service.

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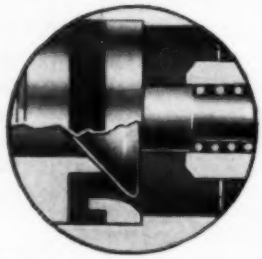

Illustration shows position of poppet under high differential pressure condition. Note the metal to metal seal as well as the rubber seal.

Illustration shows position of poppet under low differential pressure condition. Streamlined poppet and rubber seat provide a positive leaktight seal with differential pressures as low as 0.5 PSI.

SPECIFY CORNELIUS PNEUMATIC EQUIPMENT

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Spring Meeting of Aircraft Committee

THREE SAE Aircraft Committees, A-1, Aircraft Pumps, A-3, Aircraft Valves, Fittings and Flexible Hose Assemblies and A-6, Aircraft Hydraulic and Pneumatic Equipment, will hold their spring meeting at the Yung Hotel, New Orleans, the week of April 7-11. Les. J. Henderson, chairman of Committee A-3, announces his committee will meet on Monday, April 7; Committee A-1, under the chairmanship of J. Milton Kidd, will meet on Tuesday, April 8; Committee A-6, with B. R. Teree in the chair, will meet for three days, Wednesday, Thursday and Friday, April 9, 10 and 11.

Copies of the agenda to the A-6 meeting have been sent to members of the Committee, regular and occasional attendants at the meetings. Chairman Teree states that others interested in aircraft hydraulics and pneumatics are invited to attend.

Hydraulic System Materials Subcommittee

The initial group of items on the agenda will be discussed under the chairmanship of Fred O. Hosterman, who heads the Hydraulic System Materials Subcommittee. These items include: Nonflammable fluids (MIL-F-7083) including the BuAer standardization program; high temperature hydraulic systems, including the development of packings and fluids for use in hydraulic systems operating at temperatures of 300 F and higher; spiral failures in "O" rings; low friction seals and lubricants for pneumatic systems.

Pneumatic Systems

A. H. Hobelmann, chairman of the Pneumatics Subcommittee, will report on three specifications on which the subcommittee has been working, relief valve, pressure reducing valve and reservoir specifications. This is the first detailed committee work done on MIL-P-5518 Pneumatic Systems, Design, Installation and Tests in Aircraft. Mr. Hobelmann will also report on the progress made on a general pneumatic systems component specification, similar to the present one

for hydraulic systems. Mr. Hobelmann will also report on other activities and special meetings of his subcommittee in the past six months.

Leo M. Chattler, BuAer, will give a brief report of the pneumatic components tested to date and outline a program for integrating specifications prepared by the National Bureau of Standards with the A-6 Committee.

General Spec for Hydraulic Systems

Fred H. Pollard will present and discuss a survey on MIL-H-5440, General Specification for Hydraulic Systems, Design, Installation and Tests of Aircraft. Because of the natures of the changes made in this specification, the Chairman urges that every airframe manufacturer be represented and take an active part in the discussion.

R. N. Stickney, Aeronautical Standards Group representative, and Mr. Chattler will report on the status of the changes that have been made in the general specification for hydraulic components.

Hydraulic Valve Items

A number of items on hydraulic valves are on the agenda. Prominent items to be discussed are: hydraulic pressure relief valve, on which Ralph E. Middleton will present the recommendations of his Subcommittee for revision, including the in-line type of valve; 3000 psi restrictor valve; pressure regulator, four-way selecter valve; flow dividers; and directional control.

Other hydraulic component items scheduled for discussion are: filters, on which Mr. Kidd will discuss the results of a survey on the inside-out flow filter element; accumulators, with special reference to the Accumulator Specification Revision Survey requested by Harry Cornish; self-sealing couplings, on which Mr. Chattler will present a status report of evaluation tests; and reservoirs.

C. E. Deardorff will discuss the results of a survey on the power brake valve, MIL-V-5525, with a written summary. W. R. Beckerle, SAE, will give a status report on the work being done by Committee A-9 on hydraulic fluid coolers.

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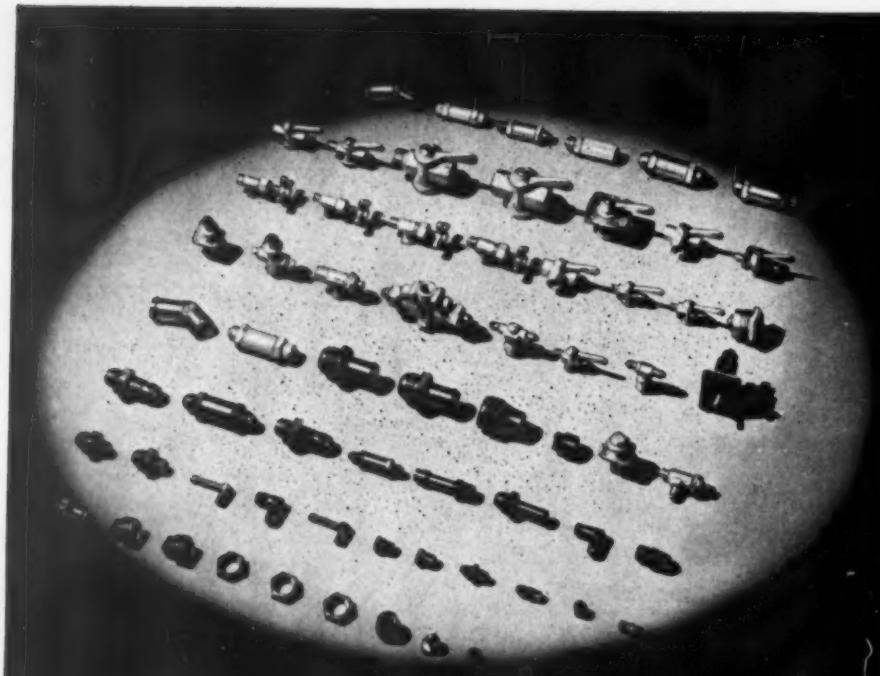

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Dispensing Cart Saves Time, Eliminates Contamination

A HANDY one-man dispensing cart in use in Mid-Continent Airlines' maintenance base at Wold-Chamberlain Field, Minneapolis-St. Paul, has resulted in a more efficient method of servicing hydraulic fluid,

alcohol and ADI fluid from standard 55 gallon drums. In addition to saving steps and the labor of carrying 5 gallon cans, the elimination of the "middle can" has done away with a major source of contamination.

The cart is the brain child of Les J. Keely, supervisor of service and aircraft overhaul and the airline engineering department. The cart has its own pump and filtering systems; the cart hoses are equipped with the same disconnect fittings as the aircraft to expedite fluid transfer.

The "go-cart" is designed to tip the barrel so that one man can handle the entire fluid servicing job. Perhaps the greatest single effort and time saving advantage in servicing the Convairs and DC-3s at the base is the elimination of extra trips to the aircraft carrying 5 gallon containers.

Four of the carts are in daily use for pumping hydraulic fluid into both types aircraft, pumping ADI fluid into the Convair tanks and pumping alcohol into the anti-icing tank of the DC-3s. In addition the carts are used to dispense gasoline into the airline's motorized equipment.

The cart is equipped with a tow hitch, making it easy to tow to a hangar parking area or to the terminal building.

POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

Earnest Y. Seborg has been appointed chief engineer of the **Barnes Drill Company.** This appointment was made by Reed M. Andress, president. Mr. Seborg is a 1931 mechanical engineering graduate of the University of Illinois, and has worked at Whiting Corporation, Edwin Pratt's Sons Company and the Ingersoll Milling Company, before being employed by Barnes Drill, where he has worked for the past fourteen years.

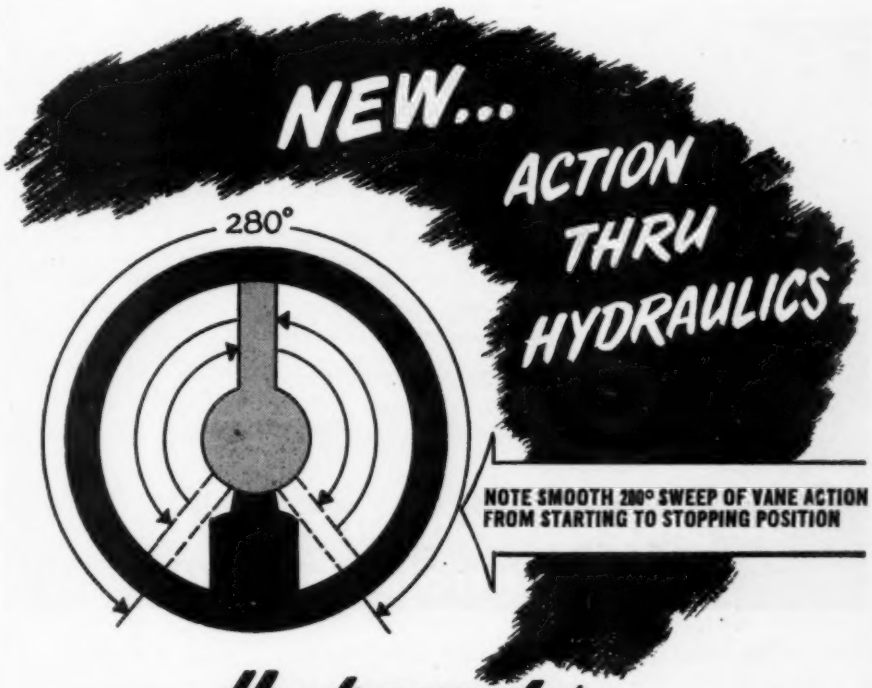
E. Y. Seborg

Dr. George O. Curme, Jr. has been elected a director of **Union Carbide and Carbon Corporation** to succeed the late James A. Rafferty, vice president and director, according to an announcement by Fred H. Haggerson, Chairman of the Board and president of the corporation. Dr. Curme, as vice president, is in charge of all research activities of the corporation.

Howard Terhune has joined **Loewy Construction Company, Inc.,** of New York, a subsidiary of Hydropress, Inc., as project design engineer in charge of the Counter-Blow Hammer Division. Mr. Terhune has been specializing in the design, engineering and sale of drop hammers, forging equipment and heavy presses for leading domestic concerns since 1906.

Robert M. McCabe, affiliated with **Vickers Inc.** since 1934 has been elected vice president in charge of purchasing.

K. R. Herman, vice president and general manager of Vickers Inc., Detroit, has announced that **Bert L. Stone** has become associated with **Vickers Inc.** in the capacity of manager of the Petroleum Pumping Equipment Division, located at the company's plant at 2160 East Imperial Highway, El Segundo, California. Mr. Stone will be assisted by **O. G. Houser** and **G. H. Vickers,** who will continue in the positions of sales manager and



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4. **May Be Stopped or Reversed, Speeded Up or Slowed Down by Simple Controls**
5. **Free of Gears or Linkage**
6. **Fully Sealed and Self-Contained — Free of Dirt and Grime**
7. **Operates with Oil, Lubricated Air or other Hydraulic Media**
8. **Often *Saves* Space, Parts, Weight**
9. **Standard Models Available for 1500 to 200,000 inch pounds of torque at 1000 psi.**

Used for: LIFTING • LOWERING • REVOLVING • SWINGING • TURNING • OPENING • CLOSING • CLAMPING • INDEXING, etc. Better investigate this fully-proven and versatile hydraulic actuator now.

WHAT POSSIBLE APPLICATION HAVE YOU ?

Hydromotor **DIVISION**

The Bonnot Company — Canton 2, Ohio

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service manager respectively of the Petroleum Pumping Equipment Division, which they have held for a number of years.

B. R. Teree, chief engineer, Aviation Division, **The Weatherhead Company** and chairman SAE Committee A-6, Aircraft Hydraulic and Pneumatic Equipment, has been elected an Associate Fellow of the Royal Aeronautical Society.

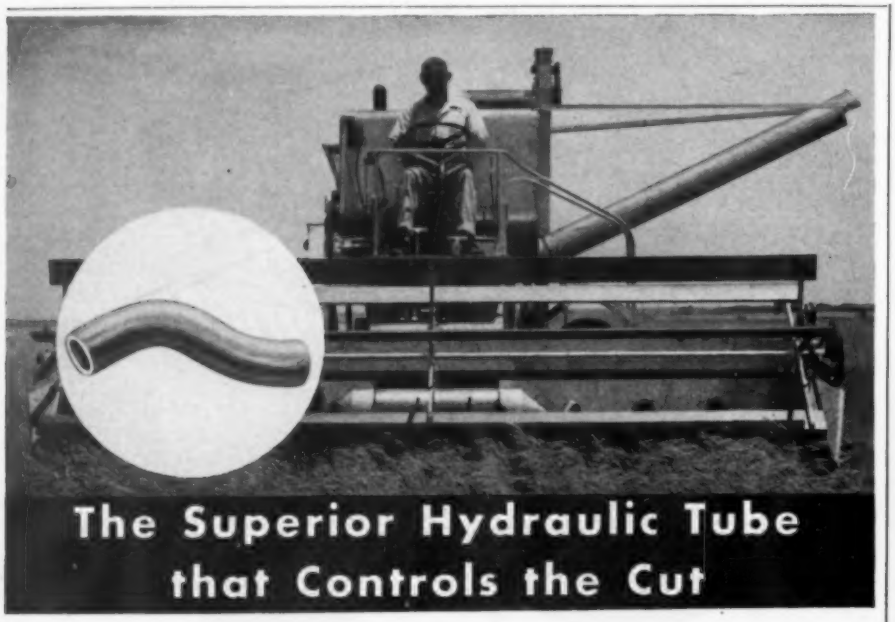
The T.W.&C.B. Sheridan Company of 135 Lafayette Street, New York and the Gray Engineering Company of 131 North Bendix Avenue, Redondo Beach, California have merged to form a new west coast engineering firm to be known as **Sheridan-Gray, Inc.** with offices in Redondo Beach. This new association brings together two major firms engaged in the designing, engineering, and manufacturing of special machine tools, for the aircraft industry. Vice president and general manager of the new firm is **Landon R. Gray,** who was one of the original founders of Hufford Machine Works, Inc., and was vice president of that firm for nine years.

The opening of a Dayton branch at 1534 Keystone Ave., of the **J. N. Fauver Company, Inc.,** whose general offices are in Detroit, is announced by C. S. Abbott, vice president in charge of sales. **Ken Miller** will be in charge offering engineering facilities and equipment in the field of lubrication, hydraulics, and pneumatics.

Clarence A. Jarosz has been appointed manager of Industrial Sales for **Bendix-Westinghouse Automotive Air Brake Co.,** Elyria, Ohio. Jarosz was assistant sales promotion manager and prior to that, assistant service manager of the Air Brake Division. He joined Bendix-Westinghouse in 1947 after 39 months service as chief engineer aboard navy destroyers. He is a mechanical engineering graduate of Case Institute of Technology.

C. A. Jarosz

Don L. Walter, manager, engineering and manufacturing and **John A. Drake,** chief engineer, of the **Marquardt Aircraft Co.,** Van Nuys, California have been appointed to technical subcommittees of the National Advisory Committee for Aeronautics for 1952. Mr. Walter was appointed to the Subcommittee on Engine Performance and Operation and Mr. Drake to the Subcommittee on Internal Flow.



Pictured above is a Gleaner self-propelled . . . and a Superior Tube that solved a problem for the Gleaner Harvester Corporation, of Independence, Missouri, who builds the combine.

On this machine the entire harvester platform, including cutter and auger is raised and lowered to operating heights hydraulically. While advanced engineering and quality production make this combine quiet and smooth in operation, considerable vibration is necessarily present . . . with consequent probable failure of ordinary hydraulic tubing.

That's why this manufacturer came to Superior for Hydraulic Quality low carbon steel tubing . . . to get a better product that will give their customers better, longer service.

If you have a need for Hydraulic Tubing for a tough job that must be well done—check with Superior. For complete information, free literature and the name of your nearest Superior Distributor, write the Superior Tube Company, 2030 Germantown Ave., Norristown, Pennsylvania.

Superior
THE BIG NAME IN SMALL TUBING
All analyses .010 to ⅝" O.D.
Certain analyses (.035" max. wall) up to 1⅜" O.D.

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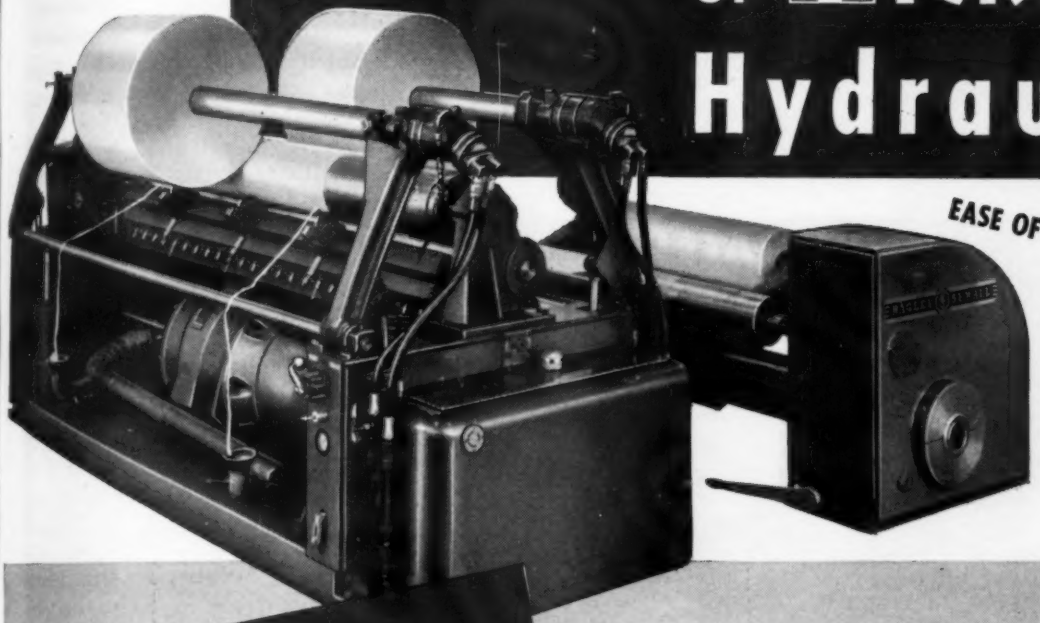
SIMPLICITY OF DE

Another COST-CUTTING APPLICATION OF VICKERS Hydraulics

EASE OF MAINTENANCE

GREATER OUTPUT

COMPACT



New BAGLEY & SEWALL No. 15 Duplex Slitter-Rewinder

Vickers hydraulic rewind drives contribute much to the efficient surface, differential or center winding of this fast-operating machine. No power is wasted. Maximum rewind shaft driving torque is set manually for each type of winding. Varying power demand of the rolls controls the speed of the hydraulic motors to automatically adjust the delivery of the variable delivery pump to the exact system requirement. Specially adjustable Vickers Relief Valve permits slow speed starting to avoid tear.

Other Vickers systems have improved performance and reduced costs for the majority of hydraulically-operated production machines built today. For details of the complete Vickers Industrial Machinery line, write for Catalog 5000 or contact your nearest factory trained Vickers application engineer.

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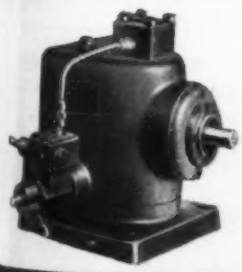
Application Engineering Offices: ATLANTA • CHICAGO (Metropolitan) • CINCINNATI • CLEVELAND DETROIT • HOUSTON • LOS ANGELES (Metropolitan) • NEW YORK (Metropolitan) • PHILADELPHIA PITTSBURGH • ROCHESTER • ROCKFORD • ST. LOUIS • SEATTLE • TULSA • WASHINGTON • WORCESTER

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



Vickers Variable Delivery Piston Type Pump with pressure compensated control—delivery is automatically regulated by signal pressure change at compensator. Capacities from 5 to 350 hp.

Vickers Constant Displacement Piston Type Hydraulic Motor. Torque is preselected by manual adjustment at the pump.

Vickers Balanced Piston Type Relief Valve

Vickers Proportional Oil Filter

4767

The **Superior Tube Company**, Norristown, Pa., has announced the appointment of **J. C. Turner** to the post of assistant treasurer. New director of purchases for Superior Tube Company is **C. F. McKenna, Jr.**, who moves up from his previous position as works accountant. A third promotion announced is that of **Kenneth L. Scheid**, who has been named chief cost accountant.

Charles F. Towse, Marvin R. Paullus and **Fred M. Berkey**, all of St. Louis, have been appointed supervisors in the engineering sales department of **Monsanto Chemical Company's** Organic Chemicals Division.

The management of the **Webster Electric Company**, Racine, Wisconsin has announced the appointment of **James H. Lahey** to the newly-created post of assistant sales manager of the Oil Hydraulics Division. Because of his previous experience with agricultural and industrial equipment, machine tools and lubricants, Mr. Lahey is well qualified to manage the details of expanding the company's present line of hydraulic pumps.

A. Gilbert Formel has become associated with **Loewy Construction Co.**, Inc., a subsidiary of Hydropress, Inc., as projects manager for heavy hydraulic presses, die forging and extrusion plants. Mr. Formel, a graduate of The University of Michigan, is a hydraulic, mechanical and licensed professional engineer.

Black & Webster, Inc., 445 Watertown St., Newton 58, Mass., have been appointed exclusive New England distributors for Barksdale hydraulic valves. They are also exclusive distributors for the Crescent line of solenoid operated air valves, and the Meletron line of pressure switches.

NEW AIR OPERATED

Hydraulic Power Unit

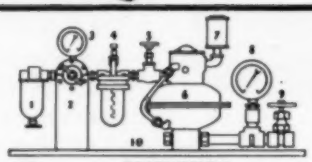
For Oil or Water Service. Portable —Weighs only 45 lbs. Utilizes Plant Air Supply to Provide Output Fluid Pressures to 30,000 PSI.

Sprague Model S-440 Power Unit is simple to install. Requires only two connections – one to plant air supply line and the other to manifold, etc. from outlet fluid port of power unit for *immediate operation.*

The Sprague pump operates *automatically* on the principle of differential areas. It can be furnished in six models with ratios of from 35:1 to 300:1 making possible an output range from 3,500 to 30,000 PSI. Measures 12"x 12"x24" complete.

Model S-440 is broadly applicable for a wide variety of uses where low volume output at high pressure is the requirement, such as hydrostatic testing. Uses either oil or water as the testing medium. Write today for complete information.

INQUIRIES INVITED FROM QUALIFIED DISTRIBUTORS IN GREAT LAKES REGION.



NO.	DESCRIPTION
10	Masonite Base ½"x12"x24"
9	Bleed off Valve
8	Pressure Gauge
7	Air Muffler
6	Sprague S-216C Pump
5	Air Shut off Valve
4	Air Lubricator
3	Air Gauge
2	Air Regulator
1	Air Filter

AVAILABLE SEPARATELY

Sprague Model S-216C Air Operated Hydraulic Boost Pump is available as a separate unit for custom installations. Measures 8¼" wide x 9⅛" deep. Simple, reliable, inexpensive. Thousands in use.

SPRAGUE *Engineering and Sales Corp.* ★ 1144 WEST 135TH STREET GARDENA, CALIFORNIA

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Engineer, Mechanical, Executive Presently chief engineer, 25 years outstanding record, design, sales, administration, hydraulic components and systems for industrial, automotive and aircraft. Box 4152 APPLIED HYDRAULICS.

Annual Proceeding of NCIH Ready for Distribution

THE annual volume of the Proceedings of the National Conference on Industrial Hydraulics is now ready for distribution, according to an announcement by John G. Duba, Conference secretary. The 1951 Proceedings, volume V of the series, contains the complete text of eighteen papers and five panel discussions. Papers are grouped by subject into aeronautical, agricultural, civil and chemical engineering hydraulics, with separate groups devoted to hose and fittings, hydraulic presses, instrumentation, centrifugal pumps, refinery hydraulics and control of surges.

Among the papers of special interest are: "Low Temperature Aircraft Hydraulic Fluids" by J. C. Mosteller and J. B. Shipp, Jr. of Wright Air Development Center; "Differential Type Hydrostatic Transmissions" by Carl L. Sadler, Sundstrand Machine Tool Company; "Hydraulics as Applied to Industrial Trucks" by Charles S. Schroeder, The Yale & Towne Mfg. Co.; "Theory and Design of Large Diameter Packings" by J. N. Smith, E. F. Houghton & Co.; "Oil Filters for Hydraulic Systems" by Arthur McHugh, Lincoln-Mercury Division, Ford Motor Company; "Hydraulic Hose Design" by John J. Millard and L. Cranston, United States Rubber Co.; and "The Growth and Application of the Accumulator in Industrial Hydraulic Systems" by Edward M. Greer, Greer Hydraulics, Inc.

In addition, the written comments at five panel discussions—automotive, centrifugal pumps, civil engineering, instrumentation and packings and filters—are included. A list of the registrants and of the financial sponsors are also included.

Copies of the 1951 Proceedings are available at $4.50 per copy from the Conference secretary, Illinois Institute of Technology, Technology Center, Chicago 16, Ill.

HILCO OIL FILTERS••

They Keep Your Oil Clean By Removing Products of Oxidation Acids, Sludge and Moisture

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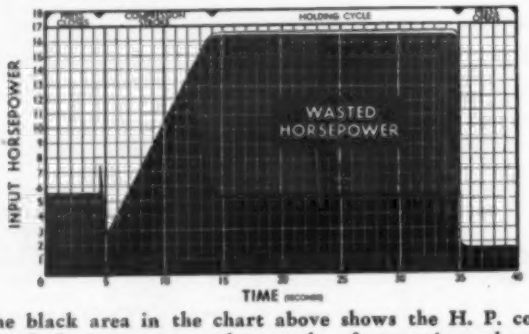
PUT ALL OF THE OIL TO WORK

Simplify the Circuit and Improve Its Efficiency

Use RACINE Variable Volume Pumps; they automatically deliver only the exact volume required. Relief valves are eliminated. Heating is reduced, horsepower saved. Over-all cost of circuit components is less. These advantages are yours when you "put all of the oil to work."

The RACINE Line is complete. Pumps to 30 G.P.M. Pressure Boosters to 5000 P.S.I. Balanced piston sleeve-type 4-way valves, straight-way valves and controls, all designed for manual electric or hydraulic operation. Complete factory and field engineering service without cost. Write for Free, complete 3-color catalog P-10-D. RACINE TOOL & MACHINE CO., 1774 State Street, Racine, Wis.



The black area in the chart above shows the H. P. consumed during one complete cycle of operation when a No. 6 RACINE Variable Volume Pump and 7:1 Pressure Booster is used. The colored area shows the wasted additional H. P. required when an efficient 2-pressure, 2-volume Constant Volume Pump of equivalent size is used. Note the savings in H. P. Chart is based on the operation of a 200-ton molding press with a 10" ram.

BUY DEFENSE BONDS

RACINE

STANDARD FOR QUALITY AND PRECISION

Oxidation of Hydraulic Oils

Concluded from page 43

moved from the system. In this case the use of concentrated detergents produces better results than the use of solvents.

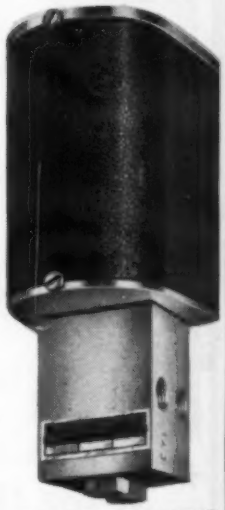
There are several factors beside the use of heat transfer units that could be incorporated in the original design of an hydraulic system that would tend to appreciably lessen the early advent of oil oxidation. The use of orifices producing jetting action should be avoided wherever possible. Sharp bends in pipes which tend to increase frictional loss and a consequent rise in temperature, should also be avoided. Locations where excessively high temperatures might be generated should be given extra provision for radiant cooling.

A surplus reservoir of hydraulic oil should be made available as an integral part of the system, preferably four times the amount of oil required in any given period or cycle. This permits any sediment or sludge that may form to settle in a relatively quiescent area, where it can be more easily removed, as well as allowing the oil to act as a coolant medium.

In other words there exists definite thermal limitations in the use of a hydrocarbon oil. These limitations, if recognized by the designer, and given serious consideration in the original design of a hydraulic system, will result in a vastly increased life expectancy for the oil.

4-WAY SOLENOID OPERATED AIR-VALVE only $32.50

For Fast Operation of Cylinders up to 3" Diameter



Compact sturdy construction, precision engineered for long, uninterrupted heavy duty operation.

Has small, well protected solenoid—operates small cylinders up to 3" dia. and larger cylinders where unusual speeds are not required.

Quantity and O.E.M. discounts. Write for description, discounts, etc.

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3-WAY VALVE
Same Design
only $19.80

AUTOMATIC VALVE CO.
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Directory Errata

In spite of the care exercised in the compilation of the 1952 Directory (January issue), a few errors did occur. Please check corrections as noted in your own copy of the Directory.

Garlock Packing Company calls our attention to the cross reference PACKINGS, CHEVRON, (Directory, page 118) as incorrect since the word "Chevron" is a registered trade mark of the Garlock Packing Company. Please cross out this cross reference.

E. F. Houghton & Co. calls our attention to the fact that they were listed under HOSE ASSEMBLIES but not under "Hydraulic Fluids" (Directory, page 172). This error was the result of makeup. Please mark column one to and including listing "C.A. Norgren Co." to column two after listing "Gits Bros. Mfg. Co.". This is in the Aviation Products section of the Directory.

Ledeen Mfg. Co. advises that, while correctly listed under BOOSTERS, AIR and HYDRAULIC CYLINDERS and GENERAL PURPOSE, LOW PRESSURE VALVES, they were omitted under several other valve classifications in the Industrial Products section. It happens that several additional air valve classifications, namely solenoid, open and shut, pilot operated and remote controlled, were omitted solely for space reasons and the cross references for these classifications were given as VALVES, AIR, DIRECTIONAL. Please add Ledeen Mfg. Co., 1610 S. San Pedro, Los Angeles 15, Calif. under this classification on page 150. All the valves made by Leeden are correctly listed in the Manufacturers' List, page 57.

C. B. Hunt & Son, Inc. 1911 East Pershing St., Salem, Ohio, should be added to VALVES, AIR DIRECTIONAL on page 150. Also refer to valves listed under this company's name in the Manufacturers' List, page 55.

Superior Hydraulics Division of Superior Pipe Specialty Co. was not listed under ACCUMULATORS in the Industrial Products and Aviation Products sections of the Directory. Please add Superior Hydraulic Division, Superior Pipe Specialty Co., Cicero, Ill. to the accumulator list on page 67 and page 166.

British Messier Ltd. Cheltenham Road, East, Gloucester, England, points out a typographical error in their listing on page 183. To correct your Directory, please cross out the mispelled word "Quualdruplex" to make the listing read correctly.

Aeroquip Corporation should be added in the Industrial Products Section under FITTINGS, TUBE on page 98, and FLEXIBLE METAL HOSE AND TUBING on page 98. In the Aviation Products section please list the Aeroquip Corporation under FITTINGS, HOSE on page 168, and HOSE, AIR on page 170.

BE COMPETITIVE

27.03%

price increase since 1937

INDUSTRIAL PUMP DIVISION
OBERDORFER FOUNDRIES, INC.
SYRACUSE, NEW YORK

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New J.I.C. Circuit Guide

A handy, new kit, which gives a quick and complete key to all standard Joint Industry Conference symbols for industrial hydraulics, is being offered free of charge by the Denison Engineering Company, Columbus, Ohio, to those whose work is directly concerned with hydraulic designing, engineering, or circuit application. This kit provides easy reference and work-saving adaptation to circuit diagrams by simplifying planning, making diagrams easier to read or draw, and by saving time wherever J.I.C. symbols are used.

The kit is made up of two units —a sturdy plastic drawing template containing basic elements of oil J.I.C. symbols, and a 32 page booklet in which all key examples of circuit components are represented by symbols approved by the Joint Industry Conference of industrial equipment.

Although priced below cost at $1.00, the kit is now being offered, for a limited time, to those whose work involves industrial hydraulics without charge or obligation. Those desiring the J.I.C. Circuit Guide are asked simply to write for it on their business letterhead, stating their title or position. Schools and technical groups may inquire about special rates, which can be made on quantity lots.

New NCIH Committee Appointed; September Dates Announced

OTTO J. MAHA, vice president, Hannifin Corporation, has been named director of the 1952 National Conference on Industrial Hydraulics. Mr. Maha succeeds J. J. Slomer, Goodman Manufacturing Company, who held the post for one year. Mr. Maha served as director for the 1949 and 1950 Conferences.

The eighth annual meeting of the National Conference on Industrial Hydraulics will be held on September 4 and 5 in Chicago.

The new executive committee appointed to serve for the 1952 annual meeting are: C. J. Clark of Ingersoll-Rand Co.; C. L. Conroy of Anchor Coupling Co.; F. W. Edwards, general manager of the Centennial of Engineering; E. Montford Fucik of Harza Engineering Co.; J. J. Slomer of Goodman Mfg. Co.; R. C. Kintner of Illinois Institute of Technology; Clark Langworthy, Vickers, Inc.; J. T. Greenlee of Imperial Brass Mfg. Co.; J. T. Marshall, Bendix Products Div. Bendix Aviation Corp.; Carl E. Schmitz, Crane Packing Co.; E. W. Tanquary, International Harvester Co.; C. J. McLean of Public Service Co. of Northern Ill.; O. E. Teichmann or Armour Research Foundation, J. C. Van Gundy of The Texas Company and Louis Zimmerman of Clearing Machine Corporation.

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✓ IS IT LUBRICATED THRUOUT - AND WEARS LIKE A BEARING ?	Yes
✓ WILL IT OPERATE WITHOUT SCORING SHAFTS, SLEEVES OR STEMS ?	Yes
✓ IS IT PRECISION MADE - READY TO INSTALL IN MY STUFFING BOX ?	Yes
✓ ARE THERE TYPES AND STYLES FOR SEALING SPECIFIC CONDITIONS ?	Yes
✓ IS IT ECONOMICAL - CAPABLE OF LONG UNINTERRUPTED RUNS . . . ?	Yes

Prove this to yourself on your own equipment. Write for information on special types and styles of Durametallic Packings for your sealing needs. Ask for Bulletin No. DMAH. Durametallic Corporation, Kalamazoo, Michigan.

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NOW! BIGGER... BETTER THAN EVER
The 1952-53 Edition of
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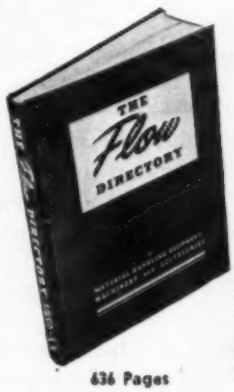

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Another Job for Pesco HYDRAULIC MUSCLES

BW

Hough Model HF PAYLOADER lifts awkward chunks of concrete in confined quarters with sure, positive control.

Positive Pesco Power for Lift, Tilt, Dump

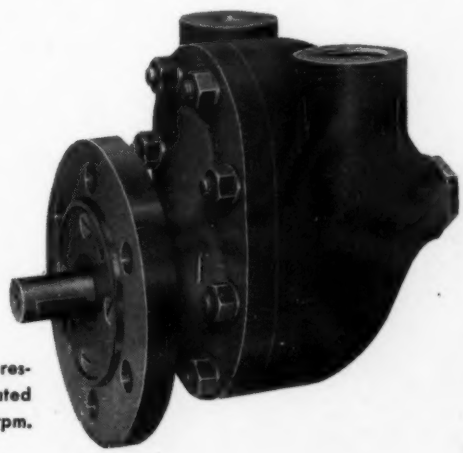
makes close-quarter work easy for a **PAYLOADER®**

High, sure lifts are made possible by the rugged Pesco hydraulic pump.

Hough PAYLOADERS, well known for their versatile, dependable performance rely on a small Pesco hydraulic pump as the heart of the hydraulic bucket control system. Power to spare is always on hand. The minute power is needed to dump, lift or tilt the bucket, it's there . . . right at the operators' finger tips.

Countless pumps on countless jobs, serving in all kinds of rugged conditions have made Pesco pumps famous for their dependable, trouble-free service. Behind the dependability of Pesco hydraulic equipment are years of research and practical know-how.

This knowledge can be of benefit to you. Write today stating your hydraulic problems. We will be glad to help.



Hydraulic pump Model 051006, gear type, pressure loaded with positive displacement. Rated capacity; 15 gpm at 1000 psi and 1200 rpm.

engineering Pesco production

PRODUCTS DIVISION

BORG-WARNER CORPORATION

24700 NORTH MILES ROAD • BEDFORD, OHIO

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Major Carl L. Sitter, USMC Medal of Honor

THE HILL WAS STEEP, snow-covered, 600 feet high. Red-held, it cut our lifeline route from Hagan-ri to the sea; it had to be in our hands.

Up its 45-degree face, Major Sitter led his handful of freezing, weary men—a company against a regiment! The hill blazed with enemy fire. Grenade fragments wounded the major's face, chest, and arms. But he continued heading the attack, exposing himself constantly to death, inspiring his men by his personal courage. After 36 furious hours the hill was won, the route to the sea secured. Major Sitter says:

"Fighting the Commies in Korea has taught me one thing—in today's world, *peace is only for the strong!* The men and women of America's armed forces are building that strength right now. But we need your help—and one of the best ways you can help us is by buying United States Defense Bonds.

"So buy Defense Bonds—and more Defense Bonds—starting *right now*. If you at home, and we in the service, can make America stronger *together*, we'll have the peace that we're all working for!"

★ ★ ★

Remember, when you're buying bonds for national defense, you're also building a personal reserve of cash savings. Remember, too, that if you don't save *regularly*, you generally don't save at all. Money you take home usually is money spent. So sign up today in the Payroll Savings Plan where you work, or the Bond-A-Month Plan where you bank. For your country's security, and your own, buy Defense Bonds now!

Peace is for the strong...
Buy U. S. Defense Bonds now!

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